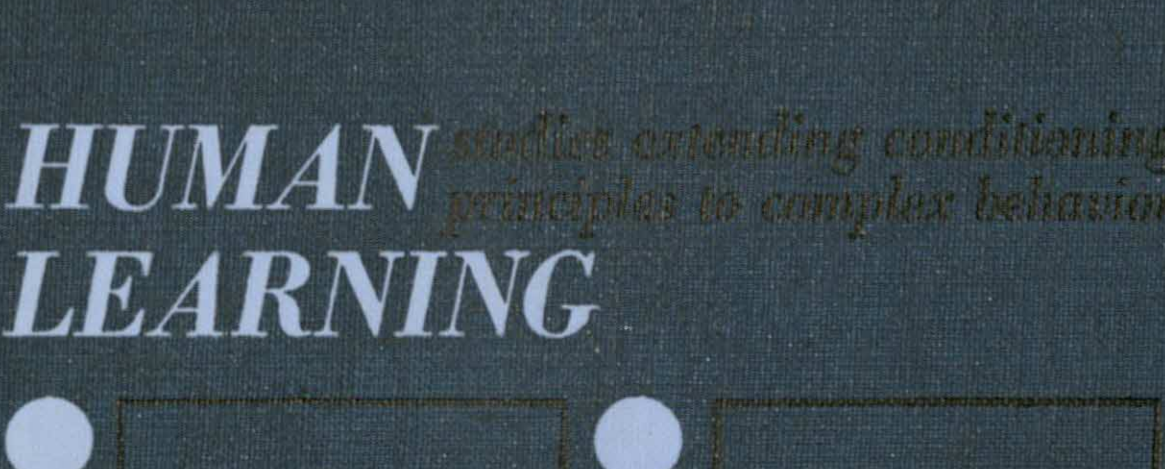
HUMAN LEARNING

studies extending conditioning principles to complex behavior



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Human Learning

Studies Extending Conditioning Principles
to Complex Behavior

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Studies Extending Conditioning Principles to Complex Behavior

Arthur W. Staats
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Library of Congress Catalog Card Number: 64–21820
28101–0214

Printed in the United States of America

In memory of my mother, Jennie Yollis Staats

In memory of my mother, Jennie Yellis Stark

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Preface

Since graduate school days I have been interested in understanding complex human behavior as it is learned. This interest has led me to examine articles in a large number of different journals, to theoretical and laboratory research with child and adult subjects, and to the development of courses in complex human learning. In this study it has appeared to me that a feasible strategy was to employ as the basic theory an integration of empirical principles, cutting across various theoretical orientations. With such a theory it seemed possible to handle a good deal of naturalistic and laboratory evidence concerned with human activities. (The formulation which has resulted from this study has been set forth by me, with the help of my wife, Carolyn Staats, in the book called *Complex Human Behavior*.)

The articles which I have selected for presentation herein fit this general scheme. They have been chosen to be extensions of empirical conditioning principles which are acceptable regardless of theoretical learning position. I have attempted to avoid enmeshment in theoretical controversies. Although some articles employ theoretical terms, such as *implicit responses*, they are with few exceptions of a response or stimulus nature and still involve the extension of empirical conditioning principles.

The present book will introduce an approach to the field of human learning, based upon what I see as a shift of interest that is more and more becoming evident. The systematic experimental study of the principles by which environmental events shape behavior *began* largely with animal subjects. The studies which were conducted using human subjects tended to be analogous to the animal studies in their attempt to establish basic analytical principles. As such they tended to be rather widely removed from significant problems of human behavior.

However, unobtrusively, a number of studies have been emerging that demonstrate the shift from the use of human subjects for the study of learning principles *per se* to the use of basic learning principles and methods in the study of human behavior. Investigators working within this general framework have developed experimental techniques and procedures with which to study various areas of significant human behaviors, and have produced a body of findings which has not yet been organized and published in book form. The products of this area of investigation appear to have importance for every field concerned with environmental influences on the acquisition and maintenance of behavior in humans.

The present book attempts to fill the gap in the textbook coverage of this significant advance. Because of this purpose I have not included studies in human learning which do not have well-developed extensions to complex human behavior. Thus, for example, traditional studies in paired-associate and serial verbal learning have not been sampled except as they are relevant to complex behaviors, for example, thinking and problem solving.

There are additional purposes involved in bringing these representative articles from the described area of study together in one book. The individual articles when viewed in isolation merely represent interesting demonstrations of learning in a new context of human behavior. Together, however, the various articles form a powerful conception of large aspects of human behavior. It is frequently said in various behavioral sciences that human behavior is acquired (learned), not laid down in biological structure. To the extent that this is true, a conception of human behavior based upon empirical learning principles would constitute a basic science for the behavioral sciences.

Thus, the present book is a reflection of the development in the application of learning principles to the study of human behavior and its problems. It is hoped, also, however, that it will focus this development and provide a stimulus as well. In this there are several dominant themes. First, the various studies suggest that an integration of empirical learning principles and methods will serve as a general approach to the study of human behavior and its problems. Second, information on contemporary research procedures for this study are described in the articles. These methods constitute an important set of tools for the empirically minded student of human behavior, and with the content of the articles will suggest further advancements. In addition, the set of articles provide support for the view that learning psychology is entering upon the phase of a science where basic principles and methods become applicable to the study and solution of complex problems. And, last, as is explicitly stated in one selection and shown by example in the others, the application of basic principles in a science to more complex cases and to actual practical problems is an integral part of the generalization and verification of the principles and the science. I hope the articles to be presented will encourage empirically oriented students of psychology that this type of extension of learning principles is becoming a major path in the advancement of their science.

Because the present group of readings is based upon a set of principles, it presents the possibility of being more integrated than most books of readings. The editor has attempted to enhance this quality in selecting the articles and in organizing them both within and between the various parts of the book—although this does not follow simple rules, and does not hold in all cases. Within each of the eight areas there is an attempt, where possible, to begin first with articles which present principles upon which the later articles will be based. In addition, to some extent the order of the areas was arranged in the same manner.

The introduction which I have composed for each area also aims to organize the studies with respect to one another so that the readings will be more likely to yield an integrated understanding. In addition, however, the introductory sections attempt to abstract important points which will help in understanding the article, and at times introductions will to some degree include interpretations as part of the task of fitting an article into a consistent set of learning principles.

In terms of the use of the book as the text in a course, I have assumed the student will have an introduction to the basic principles of operant and respondent conditioning. With such a background the book could serve as the text in second courses in learning or in courses in human learning. In other courses the book could serve as a text where it was supplemented by an accompanying text or set of lectures which presented the basic principles. Courses in general psychology might fall into this category. In addition, however, the book may be used as a supplement in various fields of general psychology concerned with human behavior where the effects of environmental events are important, for example, child psychology, social psychology, or personality. The book is especially relevant to child psychology courses. Almost half of the articles deal with children, and most of the others involve material important in child learning. And, from a learning orientation, all of the articles deal with the study of personality, since this field is concerned with the acquisition and function of complex human behavior. Instructors of social psychology courses interested in environmental effects on human behavior should also find most of the articles to be relevant to their field.

The book is also intended for graduate students of educational psychology who have a primary concern with the applications of learning principles to learning problems in children and adults. The need of such students for a background in human learning principles, methods, and contemporary findings is made more crucial by the recent developments in the application of learning approaches to educational problems. As is the case for the other courses also, there is no text at the present time in the field of educational psychology which presents the material introduced in the present book.

I would like now to acknowledge the scientific and scholarly acumen of the authors who have contributed articles as well as their kindness in giving reproduction permission. Appreciation is also due the editors and publishers for the original presentation of the articles as well as for giving reproduction permission. Each selection will have a specific permission citation.

In the work which has led to the formulation underlying the selection of this set of readings as well as to some of my own articles which this book includes, there are a number of people to whom I would like now to express appreciation. I would like first to express my gratitude to Carolyn Staats, not only for her help in various ways on a number of my projects, including reading proof for part of this book, and as an interested and encouraging colleague, but also for her personal contributions as my wife and the mother of our children. Other colleagues have contributed to one or more studies; among them are Richard E. Schutz and Lloyd L. Brooks. And a number of individuals contributed as graduate students to my research; these include Donald Biggs, Hugh L. Crawford, Judson R. Finley, William G. Heard, Karl A. Minke, Larry P. Nims, and Montrose Wolf.

Research and scholarly activity, however, also require support of a material kind. In addition to the support provided by Arizona State University through the efforts of Deans Arnold Tilden and Karl Dannenfeldt, Departmental Chairmen Arthur J. Bachrach, and the late Hudson Jost, several governmental agencies have been very important to me. I owe special thanks to the Office of Naval Research and its representatives Glenn L. Bryan and D. D. Smith for their long-term help which is reflected in some of the articles included herein. In addition, the National Institute of Mental Health and the Office of Education have made contributions for which I am grateful. Recognition of the support of specific articles will be indicated at the bottom of the first page of the articles involved.

The critical evaluation and suggestions contributed by Albert Bandura and Robert M. Gagne were very much appreciated.

In addition, Judson R. Finley and Mrs. Jane Little assumed primary responsibility for the preparation of the manuscript and to this task devoted more than the usual care—for which I am grateful.

Arthur W. Staats

Tempe, Arizona
May 1964

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Human Learning

Studies Extending Conditioning Principles to Complex Behavior

chapter I

Introduction

A SOUND STRATEGY to approach the study of any new set of events, as exemplified in various sciences, is to deal with the more simple occurrences first, in order to establish basic principles. This is done when the study turns to the analytical procedures of the laboratory, where the attempt is made to simplify matters by manipulating a very few conditions (independent variables) to observe their effects upon some other condition (dependent variable). Complications are excluded by insuring that other conditions which would act as independent variables do not influence the outcome, even though in everyday life the various independent variables may act simultaneously. Thus, for example, if one wished to observe the effect of the *number* of paired presentations of a conditioned stimulus and an unconditioned stimulus (the independent variable) upon the strength of conditioning (the dependent variable), he would have to keep the time between the presentation of the *CS* and *UCS* constant. For time between *CS and UCS* also acts as an independent variable in affecting strength of conditioning.

Later in a science, after the basic, analytic principles have been established by means of laboratory experimentation, more complex constellations of interacting variables may be considered. Ultimately, after the basic principles have been verified in more complex situations, the principles and procedures developed may be applied to the solution of important practical problems.

This type of development appears to be taking place in the experimental study of the effect of environmental occurrences (independent variables) on behavior (depedent variables). In life there are complex environmental variables acting on complex behaviors. To separate these relationships and discover the basic principles, the experimental psychology of learning turned to laboratory simplification. This has meant that experimental learning was long restricted largely to the study of simpler organisms, simple situations, and simple behaviors.

From these investigations, however, has emerged a set of principles of learning which, although they are not entirely complete, nor without controversy, seem to form the basis of the type of development which has been described. That is, the later stages of the development of a set of scientific principles have commenced in this area of study. First, the basic principles and procedures have been extended to studies with the more complex organism "man," under conditions of laboratory control. Even when the behaviors are simple and the situation is simple, these studies constitute an important advance because they indicate that the principles apply to man and they begin to form a concept of man's behavior. One or two of the studies to be presented herein are of this type. An example might be the test of principles of conditioning using children as subjects, such as Selection 3 in Chapter II.

A further advance in the science of human behavior is made when the basic principles are extended to more complex behaviors of man, or behaviors which are more unique to man. This may involve more complex situations also. Many of the examples in the book are of this type of extension, for example, the articles which approach the study of verbal behavior (see Chapters II and III) in terms of conditioning principles.

Lastly, when the behaviors involved in the study are of importance to human adjustment, then this represents actual application of basic principles to the solution of practical problems. Some of the studies to be presented are in this category and may also suggest how further advances may be made in applying learning principles to human problems. Thus, there are studies in which conditioning principles are utilized to improve training techniques in educational psychology (Chapter II), or where the principles are applied to the treatment of abnormal behavior (Chapter IX).

This type of development, where basic laboratory established principles are extended to more complex cases, involves important considerations for a certain type of theory construction in psychology. To begin with, it may be said in general that when a scientific principle (for example, a relationship between independent and dependent variables) has been established under certain conditions, it constitutes a hypothesis when it is extended to a new set of conditions. If the principle is verified under the new conditions, the confidence in the principle is increased as well as the generality of the principle.

When a related set of principles is being extended to a new area the set may be considered to be a conception or theory. Again, the principles must be corroborated in the new context for the theory to inspire much confidence. It has been indicated (Braithwaite, R. B., *Scientific Explanation*. Cambridge: Cambridge Univer. Press, 1955), however, that in applying a related set of principles there are several types of verification. The individual principle involved may receive direct verification in an experiment. When this occurs, however, the experimental support applies not only to the specific principle involved, but also indirectly to the other related principles.

The related set of basic principles of conditioning may be considered to be such a conception or theory when the set is extended to man's behavior. Verification of the basic principles as a conception of man's behavior comes when the principles are shown to function in that context. Thus, when one learning principle which was established with lower organisms is verified with human behavior, the principle may be said to receive support. In addition, however, the verification suggests also that other behaviors are learned and that other basic learning principles are also relevant to the behavior of man.

The articles presented herein may be considered to be part of this type of scientific progress. Many experiments are described, each of which supports the extension of one or more conditioning principles to an aspect of man's behavior, and thereby indirectly supports the extendability of the whole set of principles to additional human behaviors. This is discussed here so that the reader may have in mind the general nature of the endeavor involved. In addition, the reader may then evaluate the extent to which the various articles give support to the set of conditioning principles as a sound theory for many of man's behaviors. (In developing this rationale the author has also selected a set of learning principles that together seem capable of accounting for a great deal of human behavior. The reader is referred to Staats, A. W., and Staats, C. K., *Complex Human Behavior*. New York: Holt, Rinehart and Winston, 1963 for the more complete account of the rationale as well as the set of conditioning principles.)

The following group of studies are only representative of those which extend the basic principles of conditioning to the study of human behavior. The studies are arranged into eight additional chapters: Child Learning; Verbal Behavior; Communication; Problem Solving; Attitude Learning and Human Motivation; Social Interaction, Attitude Function, Group Cohesiveness, and Social Power; Personality; and Behavioral Treatment. Each chapter includes a number of experimental or theoretical articles. The eight sections were selected because they are important areas of study in complex human behavior, and because there is in each area a substantial group of studies which appear to have general significance for understanding man's behavior.

chapter II

Child Learning

From a learning approach it would be expected that the child's experience is most important to his later behavior. It is in the period of childhood that progress is made from an organism with a very limited repertoire of motor and verbal behaviors under poor environmental control to an organism who has extremely complicated verbal and motor behaviors under complex stimulus control—including subtle social controls.

It has been assumed in many cases that this acquisition of behavior occurs on the basis of internal maturational processes. In fact, a great deal of the research in the area of child psychology has been from such an orientation. Interest in pursuing a learning approach to behavior, however, rests upon the conviction, and demonstration, that experiential events mold important aspects of the child's behavior development, according to discoverable principles. This chapter, and most of those to follow, sample some of the studies which provide such a demonstration. To start with, the first article by Fowler presents a review of the literature which has dealt with the relative importance of learning (nurture) versus maturational (nature) variables, as well as some of the reasons why learning variables must be considered important to the development of some complex human behaviors. Fowler also points out that the past emphasis on the biological (maturational) approach has hindered advancements in understanding how the child learns. On the other hand, learning approaches have in the past been restricted largely to studies of simple behaviors, many times with simple organisms. Fowler also indicates areas in which research on child learning should be conducted and presents some recommendations concerning the need for long-term experimental study of complex child learning which agrees with some of the later studies to be presented.

Actually, although the learning versus maturation controversy may have, in general, retarded the systematic study of complex learning in children, the extension of learning principles to the study of child behavior had an early beginning with the application of the principles of classical (or respondent) conditioning. The study by Watson and Rayner demonstrates the principles in the context of the acquisition of childhood fears.

More recently, the experimental technology for the study of learning in children has undergone a rapid development. This development has largely been concerned with operant (instrumental) conditioning. Bijou and his associates have made significant contributions to this development and the next selection is chosen as an example. This article by Orlando and Bijou shows some of the advances which have been made in the technology of studying behavior principles in children. The response measure used is continuous and records responses automatically. Minute to minute changes in behavior as a function of independent variables can be reliably observed. This advance in technology allows sensitive study of the principles by which environmental variables control behavior. Like the preceding and the following studies, the continuity from principles and procedures established with lower organisms to the behavior of humans is shown, and this continuity will be further demonstrated in later articles within the context of complex behaviors significant to the child's life adjustment.

The study of Orlando and Bijou also indicates how special populations of children can be experimentally studied. Through these techniques the principles of behavior which are operative can be compared to those which function for normal children. And the principles appear to be the same. Later articles in this book will extend this suggestion. However, it is useful now to indicate another example of the types of children's behavior problems which can be studied by means of these principles and methods. The study by Baer suggests that the problem of thumbsucking may be approached from a consideration of reinforcement principles, as well as the more general point that experimental procedures may be adapted for working with problem behavior.

The next article by Simmons and Lipsitt indicates how the first acquisition of behavior by human infants may be experimentally studied by making the necessary adaptation of laboratory procedures. As the authors conclude, the procedures outlined "offer a technique for the study of learning and discrimination processes in the human infant" and suggest that sensory capacities could be studied in nonverbal children using variations of method. It may be added that the procedures might also be adapted for the study of other important human behaviors, for example, the first language acquisition of children, the development of social reinforcers, and so on.

Bandura (see Bandura, A., Social learning through imitation, *Nebraska Symposium on Motivation* (M. R. Jones, ed.). Lincoln: Nebraska Univer. Press, 1962) has indicated in various articles that he feels that in many cases consideration of human learning in terms of direct reinforcement of behavior is too simple-minded. He suggests that observation of other people's behavior and the consequences of that behavior (that is, reinforcement contingent on the behavior) can also affect the observer's behavior. The experiment included in this section by Bandura, Ross, and Ross is important in indicating how "imitative learning" effects can take place. (See Chapter 7 also.) Especially interesting is the fact that the child's experience is with film, not with people themselves. This has implications for considering the effects of mass communication on child learning.

In addition to the effects of learning upon behavior, an important determinant of human behavior is to be found in "motivational" variables. Central to this topic is the assessment of stimuli which have a strengthening, or reinforcing, effect when they follow behavior—as well as the conditions which determine the extent of this reinforcing effect. Some stimuli have this effect on an unlearned basis, but for man many of these stimuli are conditioned reinforcers of a social variety and only acquire their reinforcing value through having been paired with other reinforcers. The study of Gewirtz and Baer indicates that the same motivational principles found with lower organisms and unlearned reinforcers, also operate with children and social reinforcers in terms of determining the strength of the social reinforcer. Generalization of this result makes an important contribution to the understanding of human motivation (see Chapters 6 and 7).

1.

Cognitive Learning in Infancy and Early Childhood*

William Fowler[1]

How early can a child learn complex cognitive operations? Can a preschool child make substantial progress with verbal symbols and other abstract concepts? If so, how soon and under what conditions? Strangely enough, these important questions scarcely have been asked in the psychological literature during the present century. Why?

In this review we shall try to answer these and other related questions through a critical examination of representative studies on cognitive learning in early childhood. Our object is to show how the neglect of certain key problems has contributed to psychology's low estimate of the young child's potential for cognitive learning. . . .

---

* From W. Fowler, Cognitive learning in infancy and early childhood, *Psychol. Bull.*, **59**, 116–152 (1962). Reprinted by permission of the author and the American Psychological Association.

[1] The writer is much indebted to Helen L. Koch for her critical reading of an earlier version of the manuscript.

Motor Development

There have been two main types of studies of motor processes in children, other than those of the short-term learning variety. Both of these have been typically cast in the framework of maturational hypotheses. In one approach, producing the greater bulk of studies, work seldom has gone beyond defining and measuring a range of more or less simple motor skills, both gross (e.g., crawling or climbing) and fine (e.g., apprehending or releasing a pellet). Little attention has been paid to the influence of experience on the development of these skills. It usually has been assumed that skills are acquired through "normal" processes of maturation, following a definite sequence of "stages" of motor development. Gesell and his followers at Yale (e.g., Gesell, Halverson, Thompson, Ilg, Castner, Ames, & Amatruda, 1940; Gesell & Ilg, 1949), Bayley (e.g., 1935), Shirley (e.g., 1931), and others have accumulated much data of this nature.

The second type of motor investigation has been designed to determine the relative importance of maturation and learning in early development (cf. Gesell & Thompson, 1929; Hicks, 1930a, 1930b; Hicks & Ralph, 1931; Hilgard, 1932, 1933; McGraw, 1935, 1939; and others). The introduction of moderately long training periods, the teaching of relatively complex skills, and the use of control subjects are all found in this class of studies. In these studies an experimental group (or identical twin) usually has been trained for several weeks or more. Controls have then been given similar training, but often for shorter periods. Experimental and control children have been alternately kept in a normal or deprived environment while the matched groups have undergone periods of training. In some cases (e.g., Hicks, 1930a, 1930b) the control group was given no special training.

Nearly all investigators have found some evidence that, while training in specific skills often improves performance, the amount of learning has been greater when the training has been deferred until the children were at least a few weeks older. They have frequently concluded, therefore, that age (maturation) is a more vital agent than experience in development. Many believe that training in skills of this type is more efficient as neural structures mature—up to a certain "optimum" age, which varies with complexity of skill.

Often underplayed, however, is the fact that specific training has invariably produced large gains, regardless of whether training came early or late in development. In addition, partly as a result of the maturational bias, there have frequently been methodological shortcomings. These have further lessened awareness of the influence of experience upon development. In the first place, most studies have dealt with simpler skills for which there is evidence of ability "ceilings" or physiological limits. For example, in Hilgard's (1932) experiment on teaching 10 2–3 year old children buttoning, climbing, and cutting with scissors, the experimental children's learning curve tended to fall off toward the end of their 12-week training program. Such a ceiling limits the relative advantage possible from longer training. Similarly, Shirley (1931) met limited success in trying to accelerate the speed of development in walking of her 25 infants. Again, are we not dealing with a skill tied closer to biology, as McGraw (1935) suggests, than is true for more complex skills and categories of knowledge?

Interesting evidence on the importance training may have in developing complex skills is reported by Mattson (1933). She found, that in subjects ranging from 58 to 72 months in age, training in a rather simple rolling-ball maze yielded little if any advantage to the trained group. With more complicated patterns, however, and as the patterns grew in complexity, the superiority of the trained group increased over that of the untrained.

Another frequent error in experimental design has probably produced an advantage for the control children. Prior to their own training, and while the experimental children were undergoing training, the controls typically received a certain amount of experience in related motor activities as well as in cognition generally. Both of these types of experiences would be expected to facilitate the subsequent learning of the controls. Yet most investigators in their conclusions, while mentioning these related experiences, have been inclined to count gains accruing from this period as the work of maturation alone. It appears, then, that maturation and general experience have been confounded. Moreover, given the stress in the American culture upon the value of sensory-motor experience, this influence upon the development of the controls should not be minimized. . . .

Language

The language area provides still another study where Gesell's twins were used. This study was also inspired by an emphasis on maturational factors. Strayer (1930) stimulated Twin T verbally (word-object associations and simple commissions) from the ages of 84–88 weeks (inclusive), while Twin C was confined to a similar but language deprived environment. Twin C was then given 4 weeks of equivalent language stimulation, during which time Twin T experienced a normal speech environment.

Over 4 weeks of their training programs, C acquired a vocabulary of 30 words and T learned 23. But the difference in rate of learning was slight, 1.074 to .936 words per day, respectively, for their first 29 words. Moreover, in total vocabulary (35 for T versus 30 for C), sentence structure and pronunciation, T was perceptibly superior to C, following T's only slightly longer but earlier training. Twin T also appeared to be gaining in rate over C toward the close of the training. The really critical variable is contained in the additional 5 weeks of general cognitive (though largely nonlanguage) experience, that C accumulated prior to beginning training. We must also reiterate our other criticisms of this kind of design, chiefly, (*a*) the fact that the major progress of both twins was obviously associated with their specific training and (*b*) the significance of training was not demonstrated effectively because it was too brief. This second point would have been more dramatically illustrated, for example, had T's training been continued for 6 months or more, while C was confined to a deprived or "average" language environment.

Dawe (1942) has contributed the only investigation using even relatively long-term language stimulation during the preschool years. She used older children ranging from 43 to 82 months in age. Dawe also studied other aspects of cognitive learning which will be reported further on. Coming from a deprived, orphanage environment, the subjects' mean IQ was only 80.6 at the outset. Using matched controls of 11 pairs of children, Dawe gave the experimental group about 50 hours of training per child in language and general information concepts. Training consisted of viewing and discussing pictures, listening to poems and stories, taking excursions, and making simple observations. On nearly all cognitive measures the improvement of the experimental group over their controls was significant at the 1% level. This included language measures of mean sentence length and the Smith-Williams vocabulary test. Indices of intelligibility and complexity of organization of speech also rose, but not significantly. Considering that training was restricted largely to weekends and lasted only 3 months, compared to the children's 4–7 years of total life experience, gains were indeed sizable. Additional designs of this type but embracing younger children from more normal backgrounds and over longer time spans should be carried out.

A study by Milner (1951) offers promising retrospective information on the value of early language experience. Taking those first grade Negro children who scored contrastingly high and low on a language development test, she compared the two groups with respect to measures of their social background. The high language scorers were found to have participated much more widely in adult family conversation and received more overt demonstrations of affection. Other analyses of preschool children's histories have also shown the importance of adult relations and other home variables for the development of children's language (Smith, 1935; Van Alstyne, 1929; Williams & Mattson, 1942).

Beyond the foregoing studies, interest has centered on reporting age "norms" for acquiring various dimensions of language. It usually has been assumed that these norms directly reflect age-linked, maturational levels (cf. Chen & Irwin, 1946; Lewis, 1936; McCarthy, 1930; Smith, 1926). But developmental norms can as readily be subject to environmental as to an innate growth interpretation, although interpretations of the former kind are infrequent. To illustrate an environmental approach, Ames and Learned (1948) record that the biggest jump in the addition of new space concept words occurs between 2–2.5 years. Is it possible that cultural stimulation in these concepts typically increases around this age so as to produce this jump? If so, shouldn't we ask whether cognitive development in this and other areas could not further be enhanced at all ages by the introduction of programed stimulation?...

Conceptual Processes and Intelligence (IQ)

A heavy interest in the nature-nurture of intelligence (IQ) has been accompanied by a massive accumulation of studies, however thin in definition the problem has remained. As these studies have been covered extensively in many reviews (Anastasi, 1958; Jones, 1954; Wellman, 1945; Wellman & McCandless, 1946; Whipple, 1928, 1940; and others), we shall concentrate principally on studies and problems directly relevant to our purposes.

The largest amount of work has consisted of cross-sectional studies of children and adults of all ages. In these studies, investigators have correlated IQ test performances and environmental indices (amount of education; parents' educational, occupational, and social class level; urban-rural differences; etc.). A multitude of relationships of this kind, often important, have been found. Their value may be considered only partially attenuated by the discovery of other associations which concede greater importance to heredity (e.g., between IQ scores of parents and their children). The basic problem stems from the fact that broad, background correlations throw insufficient light on particular environmental antecedent-consequent relationships.

Few studies of any kind in the IQ area have been designed with the precision necessary to illuminate these relationships. Some valuable information has come out of the work on identical twins reared apart, but it is based on sparse case data, usually obtained through the retrospective reports of biased informants. With radical and lifelong differences in their environments, twins have often shown marked differences in IQ scores in later years, up to as much as 24 points. In fact, twins have been found to differ in IQ almost in proportion to the degree of discrepancy experienced in cognitive features of their environments (Newman, Freeman, & Holzinger, 1937). Woodworth (1941), tallying data from existing studies, derived a correlation of .79 between differences in amount of education and differences in IQ scores.

Investigations on adopted children (mainly, Burks, 1928; Freeman, Holzinger, & Mitchell, 1928; Leahy, 1935; Skodak, 1939; Skodak & Skeels, 1949) provide another good though still imprecise source of information regarding environmental influences on IQ scores. Many of the children were placed for permanent adoption when only a few weeks old and were sometimes followed regularly over many years. But IQ measures were not always taken during the early years and the kind of training the children received was never specified nor controlled. As a result, the effect of experience, especially early experience, upon intellectual development remained essentially unknown.

Among other important methodological oversights has been the failure to consider the influence of prenatal and neonatal factors or of selective placement. In addition, sample homogeneity has usually been greater among the foster children than among their controls. These problems are discussed at length in other sources (Anastasi, 1958; Jones, 1954). The typical IQ correlations between foster children-natural parents have ranged from .4 to .5. But it is evident that these correlations represent inflated values due to selective placement and sample homogeneity of the foster children. These two factors also have minimized IQ correlations between foster parents-foster children, further obscuring the influence of the environment. Nevertheless, in the Skodak and Skeels (1949) longitudinal study of 100 foster children, the mean IQ difference between foster children (from the age of less than 6 months through 13 years) and their natural mothers remained consistently at about 22 points. This is a sizable difference to persist in the face of methodological factors conceivably working in an opposite direction.

Historical surveys of "gifted" children, if again more descriptive than precise, have furnished additional, important clues on the function of early cognitive stimulation (Cox, 1926; Davidson, 1931). The association between cognitive precocity and the application of intensive stimulation from infancy has always been impressively high. This suggests a need for revising the concept gifted, since it is so heavily weighted in favor of heredity alone.

In fact, this writer has managed to assemble from various sources a sample of 25 superior IQ children, all of whom learned to read by the age of 3 (Cox, 1926; Davidson, 1931; Dolbear, 1912; Hollingworth, 1926, 1942; Jones, 1923; Root, 1921; Stoner, 1914; Terman, 1917, 1918, 1924). Of these, 72% had definitely enjoyed a great deal of unusually early and intensive cognitive stimulation. For the other 28% evidence regarding the quality and quantity of stimulation was lacking in the records.

Where long-term training has been used at all, most programs have taken the form of nursery school education. These usually have been broad and uncertain in meaning and have seldom concentrated upon verbal development, an important component of many IQ tests (Anastasi, 1958; Wellman & McCandless, 1946). . . .

Of all the many studies of IQ, only four have developed long-term programs of general cognitive stimulation for preschool children. One of these is a study in progess by this investigator on three pairs of identical twins and a set of triplets. Two studies included no children younger than 43 months of age. In one study, Dawe (1942) followed the progress in language and general cognition that 11 children made over 3 months of weekend training. Details of the investigation were reported in the section on language. In addition to language gains, her subjects made significant mean gains in Binet IQ scores (14.2 points against a 2-point loss for the controls) as well as in other cognitive measures, i.e., science and home living information.

McCandless (1940) attempted to raise the intellectual level of 6 very bright (139 IQ) preschool children by means of an enriched curriculum supplementing the regular nursery school program. The children's mean age was about 52 months. The program consisted of project work (constructing a farm and a combination flower store-hotel) presented over much of 1 school year. Initial post-test differences in IQ scores (1916 Stanford) between the experimental group and their matched controls were not significant. However, retest differences the following fall reached significance on the newly revised (1937) Stanford. The retest shift was attributed mainly to the nature of the 1937 test revision, which corrected for the decline in age associated with the 1916 Stanford. These results may appear more impressive when one questions just how stimulating this kind of project work could be for children already of high ability—particularly given the Binet's heavy use of verbal symbols by this age.

Peters and McElwee (1944) furnished 8 months of guided play to 6 young subjects (aged 2–9 to 4–2) of below average IQ who attended nursery school three mornings per week. Activities were organized according to categories of "functional intelligence," although the amount of verbal stimulation offered is not clear. Home visits and conferences with the mother were also included. Although there were no controls, children registered a mean gain of 7 IQ points. While not statistically significant (.07), this included one child whose score fell as a result of obvious motivational distraction during posttesting. Taking these three studies together, their relatively well-outlined and lengthy cognitive educational programs contain many implications for education and the meaning of IQ measures.

The extensive work done on intelligence in relation to the nature-nurture problem has been the subject of vigorous discussion and conflicting findings over many years (cf. Anastasi, 1958). But one regrettable consequence has been the manner in which arguments over the relative importance of heredity and environment have obscured the fact that the environment does perform an *essential* role in development. It is difficult to argue, considering all the evidence, that environment has a *negligible* role in producing mental test variations or in developing intelligence and conceptual abilities, however important genetic factors may also be. The dispute has seriously retarded interest in experimental work on preschool cognitive learning. It also has discouraged long range educational programs aimed at developing each child to near the maximum level of his capacities. . . .

READING ABILITY

Nearly all cases of early reading come to light from historical sources or from surveys of gifted children. Information is most detailed in the accounts of children taught individually in the home by tutors, parents, or other relatives (Cox, 1926; Davidson, 1931; Dolbear, 1912; Hollingworth, 1926, 1942; Root, 1921; Sidis, 1911; Stoner, 1914; Terman, 1918; Witte, 1914). These accounts prove to be one of the best stimulants for encouraging research on cognitive learning in early childhood. Methods are sometimes fairly well described. Much of this early childhood education has been devoted to general knowledge, and many "home educators" have shared a strong belief in intensive education from birth as a *sine qua non* for the ontogeny of high intelligence.

Winifred Stoner (Stoner, 1914; Griffiths, 1923) was given a carefully graduated program of reading and wide general knowledge by her mother from the age of 6 months on. By 16 months she could read and spell, by 2 years she could write. No definite degree of proficiency is specified until age 3, when she had reportedly acquired much skill in all and was beginning to typewrite. The child otherwise participated actively in physical and dramatic peer play and from childhood on experienced much school and and some literary success. Although a controversial lay educational figure, the mother enjoyed considerable support from professionals. Her reading instruction methods (Stoner, 1914, 1916) in some ways typical of many home educators, consisted primarily of synthesizing words, using phonic principles, along with reading simple texts. Letters were presented initially in enlarged, colorful cutout forms and learning was further reinforced through an endless variety of songs, plays, games, and stories.

The case of Viola Olerich (Dolbear, 1912) is of interest in that she was adopted at 8 months by a professor, Olerich, expressly for demonstrating his ideas on the early development of abilities. He succeeded in teaching the child to read by a sentence method shortly after the age of 17 months. By the age of 2–11 she could read with "force and suggestion" almost any reading material presented to her.

An earlier illustration is furnished by a German clergyman, Witte (1914), who, before the son's birth in 1800, predicted the high intellectual abilities which his son later acquired with the help of painstaking programing from infancy. The child learned to read and spell fluently well before 5, through an alphabet-phonic method. He also became an exceptionally thoughtful and well-informed, yet modest child. Attaining his doctorate easily at 14 he later rose to eminence as a leading university scholar in literature.

Many other examples of precocious readers could be cited. Some of these, like Macauley, John Stuart Mill, Francis Galton (Cox, 1926; Terman, 1917), and Norbert Wiener (1953), came to be renowned thinkers of their time. All of them experienced intensive cognitive education from the earliest years.

Experimental investigation of early reading is restricted to some five studies,[2] plus a sixth on which this investigator is working. Of three early studies, Davidson's (1931) study on 3-, 4-, and 5-year-old children was the most extensive. The children were divided by age and ability into 3 groups of 4–5 children each, all having an MA of 4 years. The mean IQs of the respective groups were 128, 98, 77 on the 1916 Stanford.

Four months of individual and group reading instruction were offered 10–15 minutes daily in a morning kindergarten-type program. A word-sentence method was used, with the aid of play activity, motivating techniques, but drawing some attention to structural detail.

In the course of training, nearly all children made definite headway in learning to read simple primer material. Two of the bright 3-year-olds covered the equivalent of a first grade program in less than half a school year and were rapidly becoming fluent readers. Moreover, at least one (with signs of another) of the 4-year-olds of average IQ was on the verge of fluent reading, while one dull 5-year-old was making substantial progress.

An outstanding feature of this experiment is that these results were obtained even with average and low IQ children well before the usual school age of 6. Another is that mean IQ increases of 9.2, 9.75, and 10.75 points were obtained by the respective 3-, 4-, and 5-year-old groups over so relatively brief a period. Still another emerges in the fact that extensive cognitive stimulation at home (almost daily parental story reading) had been experienced only by the best readers (all four bright 3-year-olds). In contrast, only one other child had been read to more than occasionally—and she was the most successful 4-year-old reader.

In another early study, Brown (1924) experimented on short-term word training (nouns only) with 12 children, aged 3–6 to 5–11 and with another child of only 22 months. She followed a stencil-tracing method, together with the use of printed flash cards, posters, and a primer, sustaining motivation by the use of games. Two children, a girl aged 3–10, whose IQ was only 91, and a boy of 3–6, whose IQ was 140, were given 20- to 30-minute individual reading lessons in their homes, 5 days a week for 3 months.

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[2] The paucity of interest in this area, especially on the part of psychologists, is underscored by the fact that three of these studies were all performed at one place, Stanford, more than 30 years ago (Brown, 1924; Davidson, 1931; Terman, 1918), one of which was a report by Terman on an experiment by a parent; and the fact that, of the other two (Fowler, 1962; Moore & Anderson, 1960), one is by a sociologist (Moore & Anderson, 1960).

> Catherine, in 36 lessons, learned to read 11 pages of her primer. Roger in 26 lessons, reached the same point. Both children could read their charts, and the recombination of words upon the charts, with perfect ease (Brown, 1924, p. 135).

With respect to short-term word learning, even the child of 22 months, whose IQ was only 118, learned to discriminate three words in only five lessons. She still recognized them 3 months later.

One of the most remarkable and successful experiments in early reading was performed by a lay educator. It is included here because of its unusual verification and documentation, reported by Terman (1918). This anonymous father began to teach his daughter, Martha, to read from the age of 14 months, when her speech was limited to just three words. He first taught her the capital letters, so that the child's fourth spoken word was "pretty B" (pretty, being the third). Otherwise he followed a sight word method, employing play oriented techniques and fabricating simplified sentence charts.

Success was far from immediate, however. The next five months were passed primarily in teaching the child word-object relationships. Apparently, at 19 months certain important concepts developed, for Martha rather suddenly in 1 month rapidly mastered, first, all capital then the small letters. At 21 months and 10 days, with a reading vocabulary of 35 words, she made some generalization to the effect "that these word pictures represented thoughts" (p. 223) occurred. At 23 months Martha "began to experience the mental pleasure of reading," (p. 225) and had acquired a reading vocabulary of 150 words. By 26.5 months, she had covered 4.5 primers, embracing a vocabulary of over 700 words. She could read fluently and meaningfully, but her pronunciation was less perfected.

This case is unique in providing well-verified evidence of how a child of not more than 140 IQ and MA of just 3–0 years (extrapolated from a 1916 Stanford given at age 3–11) learned to read.

Of the three recent investigations, complete data is available only on one, an extensive monograph by Fowler (1962). He reports on a 9 months' exploratory effort to teach his 2-year-old daughter, Velia, to read, experimenting with a combination of methods in a trial-and-error, but carefully regulated approach. Stimulation averaged 30 minutes daily and was freely immersed in dramatic play and family routines.

During the program the subject accumulated an out-of-context, recognition vocabulary of about 250 words. Words tested had not been exposed to the subject for a mean of 18.5 days and were recognized with about 87.3% accuracy. Toward the end Velia could read meaningfully a few isolated, primer-type sentences, 2–5 words in length. She was also beginning to read preprimers, and could perceive words with increasing precision using phonic cues.

The child had also experienced a planned, broad program of intensive cognitive stimulation from her earliest weeks. This experience is believed to have been a major factor developing Velia's IQ to the high range (150–170) within which Velia scored on all tests from age 2 to 8. Moreover, in preliminary pilot work, she learned to identify with ease all capitals at 21 months and most small letters by 23 months.

Among techniques and dimensions explored at some length were dramatic play, reinforcement procedures, phonics, whole-word learning, and the effect of varying type style and size. Picture-association and various other materials and methods of presenting stimuli were similarly experimented with.

Follow-up tests and observations to age 8.5 have repeatedly revealed Velia to be reading avidly with comprehension and facility 2–3 grades above level. In addition, she continues to pursue enthusiastically a wide variety of other cognitive and social interests. It is worth recording that she is less advanced in certain cognitive areas, e.g., arithmetic, where she has received little special stimulation. Emotional problems are covered separately under psycho-social development.

Investigations in progress by Moore and Anderson (1960) on early reading and writing, are as yet published only in film form. From limited information,[3] it appears that several children, aged 3–5, have made definite progress in learning to read and write. One child, who started at 2–7, apparently reached a second grade level 6 months later. Of special interest is their method involving the use of an electric typewriter (using correct fingering), which probably enhances motivations as well as facilitates learning. . . .

MATHEMATICS

That long periods of learning are indispensable for the early acquisition of calculating and similar abilities is suggested by the following: case records, although often less complete than those on early reading, similarly point to years of exceptional, early stimulation and practice as the rule (Bell, 1937; Jakobsson, 1944; and others). Second, there is much evidence to suggest that the preschool child's successful efforts to attain high abilities have frequently been early and liberally reinforced and channelized by such social role labels as "wizard" or "genius" calculator (Barlow, 1951; Mitchell, 1907; and others). Finally, it is unreasonable to believe that even the "simpler" mathematical concepts, thousands of years in the attainment historically (Sarton, 1952, 1959), could emerge autogenously in untutored children, following Dennis' and Dennis' (1951) notion.

Yet even contemporary research on the numerical abilities of preschool children, as in other cognitive areas, is still highly concentrated on merely registering the ages and order of normal development. It is as if the development of abilities does indeed evolve autogenously or through maturation alone. In fact, no experiments were found which were directly concerned with how, or the degree to which, preschool children can learn quantitative relationships and numbers. Nor do educational theory and practice make any provision for teaching arithmetic before age 5, any more than they do for reading. Similarly, MA concepts of arithmetic "readiness" have, for elementary school programs, been interpreted rigidly in terms of age norms (e.g., Harding, 1959; Washburne, 1928).

The observations of Ilg and Ames (1951) illustrate this maturational outlook. Developmental gradients on several aspects of the number process at 6-month intervals from the age of 1 year through 9 years have been catalogued. In their usual fashion little attention is devoted to learning processes, mental growth being the descriptive framework. Similar collections of developmental observations on number concepts in early childhood have been assembled by Descoeudres (1946), Giltay (1936), and Long and Welch (1941). Piaget and Szeminska (1952) have also worked in this area, although they are more concerned with theory than with facts. Probably the most important modal shift in the acquisition of number concepts involves moving from simple perception of "oneness" and "twoness," or broad discriminations of quantity, to comprehension and accurate perception of three or more units. This takes place usually around the age of 3.5. But nearly every study finds some children who make this basic transition toward functional mastery of the number system at the age of 3 or younger (and some at older ages). Therefore, unless the explanation is assumed to be totally a genetic one, the now unprobed differences in learning opportunities should be investigated. This point is brought into sharper relief by Ilg's and Ames' (1951) observation that adding behavior begins primarily at 5 and 6, precisely the ages when most children enter elementary school. . . .

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[3] O. K. Moore, personal communication, 1961.

DISCUSSION AND SUMMARY

This critical survey of selected literature on cognitive learning in early childhood has been made in order to gain perspective on certain crucial but widely neglected research problems. Neglect of these problems has resulted in a stress on genetic factors in early cognitive development. Correspondingly, this has been at the expense of visualizing the scope and complexity of learning realizable during the initial phases of development.

Traditionally, there appear to have been two major viewpoints explaining processes of development, and to account for the protracted course children go through to acquire complex knowledge. The first view fixes on concepts derived from biology. Under this view, intelligence and various abilities are postulated as inherited. They emerge through a process of unfolding along a growth continuum in several ordered stages of maturation. Modification of this innately determined patterning by means of environmental circumstances is placed in secondary position.

In research, this view has led to a concentration on empirical studies organized cross-sectionally for collecting normative data. For the most part, these norms have been linked sequentially to chronological age levels (e.g., MA or any age-trait behavior). The use of longitudinal studies has been, logically, an important additional derivative of this view. But a maturationally oriented developmental framework has so dominated long range investigations made under its jurisdiction, as to cloud evidence which might have led to alternate conclusions. In addition, there are other important research errors and orientations which have tended to feed this bias. These include the frequent omission of adequate controls; the experimental fusion of variables; an emphasis on sensory-motor and social-emotional development to the relative exclusion of complex, perceptual-cognitive processes; and, above all, the simple omission of (antecedent) experiential data.

An important group of better controlled studies has probed the maturation versus learning issue. These studies have, in the main, continued subordinate to maturationally oriented hypotheses; have failed to separate general experience from maturation; and have too often designed training programs with only simple material and/or have covered too short a time span. These limitations have aborted opportunities for impressive gains to accrue in cognitive learning.

The second more or less opposing view, while according a greater role to experience, has generally been dominated by a behavioristic outlook. In its concern for dealing with operationally definable processes, this outlook has only recently begun to divest itself of a molecular focus which has relegated complex conceptual processes to the second-class status of "intervening variables." This outlook also has generated a situational focus abstracted from the molar life situation, history, and developmental status of the organism.

Preoccupation with precision and accurate measurement has induced many behavioral researchers to cling to high control, animal experimentation of the laboratory. This has meant a comparative neglect of experimentation on learning in children. The less frequent investigation of children has been much confined to correlational or cross-sectional study of a few isolated components of behavior. Learning processes, where studied, have embraced problems whose solution depends only upon a few simple operations acquired over a restricted number of trials. Little attention has been directed toward longitudinal work on the antecedent-consequent relations of basic cognitive dimensions. . . .

Much if not most of the energy in child psychology and development in late years has been concentrated on the child's personality, perceptual motor, and socioemotional functioning and development. Originating primarily as a reaction to historically inadequate and stringent methods, fears have generalized to encompass early cognitive learning per se as intrinsically hazardous to development. As legitimate areas of study, the contributions of studies on perceptual-motor and socioemotional problems are obvious. But in the field of child guidance, interest in these areas has come to permeate and dominate work in child development almost to the exclusion of work on cognitive learning. In harking constantly to the dangers of premature cognitive training, the image of the "happy," socially adjusted child has tended to expunge the image of the thoughtful and intellectually educated child. Inevitably, in this atmosphere, research (and education) in cognition has lagged badly, especially since the 1930s, not only for the early years of childhood but for all ages.

Even prior to the more recent era, however, very little careful research was done on early cognitive learning. As historical evidence shows, most studies have comprised the work of those "beyond the pale" of formal psychology. Yet, taken collectively, the findings are so provocative as to make us entertain hopes that many, if not all, children can and indeed should be offered much more cognitive stimulation than they have been generally receiving.

There is, however, a further problem, at once a derivative of and an important contributor to the failure to undertake work on cognitive learning. Few systematic methods have been devised for educating young children, especially in complicated subject matter. . . .

The advantages of utilizing the now relatively untapped "preschool" years for cognitive education are of course manifest. Most obvious, is the availability of more years of childhood to absorb the increasingly complex technology of modern society, a technology already requiring many of the more productive years of development to acquire. . . .

REFERENCES

Ames, Louise B., & Learned, Janet. The development of verbalized space in the young child. *J. genet. Psychol.*, 1948, **72,** 63–64.

Anastasi, Anne. *Differential psychology.* (3rd ed.) New York: Macmillan, 1958.

Barlow, F. *Mental prodigies.* London: Hutchinson, 1951.

Bayley, Nancy. The development of motor abilities during the first three years. *Monogr. Soc. Res. Child Develpm.*, 1935, No. 1.

Bell, E. T. *Men of mathematics.* New York: Simon & Schuster, 1937.

Brown, Muriel W. A study of reading ability in preschool children. Unpublished master's thesis. Stanford University, 1924.

Burks, Barbara S. The relative influence of nature and nurture upon mental development: A comparative study of foster parent-foster child resemblance and true parent-true child resemblance. *Yearb. Nat. Soc. Stud. Educ.*, 1928, **27,** Part 1, 219–316.

Chen, H. P., & Irwin, O. C. Infant speech vowel and consonant types. *J. speech Dis.*, 1946, **11,** 27–29.

Cox, Catherine M. *Genetic studies of genius.* Vol. 2, *The early mental traits of three hundred geniuses.* Stanford: Stanford Univer. Press, 1926.

Davidson, Helen P. An experimental study of bright, average and dull children at the four-year mental level. *Genet. psychol. Monogr.*, 1931, **9,** 119–289.

Dawe, Helen C. A study of the effect of an educational program upon language development and related mental functions in young children. *J. exp. Educ.*, 1942, **11,** 200–209.

Dennis, W., & Dennis, Sena G. Development under controlled environmental conditions. In W. Dennis (Ed.), *Readings in child psychology.* New York: Prentice-Hall, 1951. Pp. 104–131.

Descoeudres, Alice. *Le développement de l'enfant de deux à sept ans.* (3rd ed.) Neuchâtel: Delachaux & Niestle, 1946.

Dolbear, Katherine E. Precocious children. *Pedag. Seminary*, 1912, **19,** 461–491.

Fowler, W. Teaching a two-year-old to read: An experiment in early childhood learning. *Genet. psychol. Monogr.*, 1962, **66,** 181–283.

Freeman, F. N., Holzinger, K. J., & Mitchell, B. C. The influence of environment on the intelligence, school achievement, and conduct of foster children. *Yearb. Nat. Soc. Stud. Educ.*, 1928, **27,** Part 1, 103–217.

Gesell, A., Halverson, H. M., Thompson, Helen, Ilg, Frances L., Castner, B. M., Ames, Louise B., & Amatruda, Catherine S. *The first five years of life: A guide to the study of the preschool child.* New York: Harper, 1940.

Gesell, A., & Ilg, Frances L. *Child development: An introduction to the study of human growth.* New York: Harper, 1949.

Gesell, A., & Thompson, Helen. Learning and growth in identical infant twins. *Genet. psychol. Monogr.*, 1929, **6,** 1–124.

Giltay, M. Sur l'apparition et le développement de la notion du nombre chez l'enfant de deux à sept ans. *J. Psychol. norm. path.*, 1936, **33,** 673–695.

Griffiths, C. R. *A general introduction to psychology.* New York: Macmillan, 1923.

Harding, L. W. *Arithmetic for child development.* Dubuque, Ia.: Wm. C. Brown, 1959.

Hicks, J. A. The acquisition of motor skill in young children. *Child Develpm.*, 1930, **1,** 90–105. (a)

Hicks, J. A. The acquisition of motor skill in young children: II. The influence of specific and of general practice on motor skill. *Child Develpm.*, 1930, **1,** 292–297. (b)

Hicks, J. A., & Ralph, Dorothy W. The effects of practice in tracing the Porteus diamond maze. *Child Develpm.*, 1931, **2,** 156–158.

Hilgard, Josephine R. Learning and maturation in preschool children. *J. genet. Psychol.*, 1932, **41,** 31–56.

Hilgard, Josephine R. The effect of early and delayed practice on memory and motor performances studied by the method of co-twin control. *Genet. psychol. Monogr.*, 1933, **14,** 493–567.

Hollingworth, Leta S. *Gifted children: Their nature and nurture.* New York: Macmillan, 1926.

Hollingworth, Leta S. *Children above 180 IQ.* New York: World Book, 1942.

Ilg, Frances L., & Ames, Louise B. Developmental trends in arithmetic. *J. genet. Psychol.*, 1951, **79,** 3–28.

Jakobsson, S. Report on two prodigy mental arithmeticians. *Acta med. Scand.*, 1944, **119,** 180–191.

Jones, Alice M. The superior child: A series of case studies. *Psychol. Clin.*, 1923, **15,** 1–8, 116–123, 130–137.

Jones, H. E. The environment and mental development. In L. Carmichael (Ed.), *Manual of child psychology.* (2nd ed.) New York: Wiley, 1954. Pp. 631–696.

Leahy, Alice M. Nature-nurture and intelligence. *Genet. psychol. Monogr.*, 1935, **17,** 236–308.

Lewis, M. M. *Infant speech: A study of the beginnings of language.* New York: Harcourt, Brace, 1936.

Long, L., & Welch, L. The development of the ability to discriminate and match numbers. *J. genet. Psychol.*, 1941, **59,** 377–387.

McCandless, B. R. The effect of enriched educational experiences upon the growth of intelligence of very superior children. Unpublished master's thesis, University of Iowa, 1940.

McCarthy, Dorothea. *The language development of the preschool child.* Minneapolis: Univer. Minnesota Press, 1930.

McGraw, Myrtle B. *Growth: A study of Johnny and Jimmy.* New York: Appleton-Century, 1935.

McGraw, Myrtle B. Later development of children specially trained during infancy: Johnny and Jimmy at school age. *Child Developm.*, 1939, **10,** 1–19.

Mattson, Marion L. The relation between the complexity of the habit to be acquired and the form of the learning curve in young children. *Genet. psychol. Monogr.*, 1933, **13,** 299–398.

Milner, Esther. A study of the relationship between reading readiness in grade one school children and patterns of parent-child interaction. *Child Developm.*, 1951, **22,** 95–112.

Moore, O. K., & Anderson, A. R. *Early reading and writing (motion picture): I. Skills. II. Teaching Methods. III. Development.* Guilford, Conn.: Basic Education, 1960.

Newman, H. H., Freeman, F. N., & Holzinger, K. J. *Twins: A study of heredity and environment.* Chicago: Univer. Chicago Press, 1937.

Peters, C. C., & McElwee, A. R. Improving functioning intelligence by analytical training in a nursery school. *Elem. sch. J.*, 1944, **45,** 213–219.

Piaget, J., & Szeminska, Alina. *The child's conception of number.* London: Routledge & Kegan Paul, 1952.

Root, W. T. A socio-psychological study of fifty-three supernormal children. *Psychol. Monogr.*, 1921, **29** (4, Whole No. 133).

Sarton, G. *A history of science.* Vols. 1 and 2. Cambridge: Harvard Univer. Press, 1952, 1959.

Shirley, Mary M. *The first two years: A study of twenty-five babies.* Vol. 1. *Postural and locomotor development.* Minneapolis: Univer. Minnesota Press, 1931.

Sidis, Boris. *Philistine and genius.* Boston: Moffat, Yard, 1911.

Skodak, Marie. Children in foster homes: A study of mental development. *U. Ia. Stud. child Welf.*, 1939, **16,** No. 1.

Skodak, Marie, & Skeels, H. M. A final follow-up study of one hundred adopted children. *J. genet. Psychol.*, 1949, **75,** 85–125.

Smith, Madorah E. A study of some factors influencing the development of the sentence in preschool children. *J. genet. Psychol.*, 1935, **46,** 182–212.

Smith, Madorah E. An investigation of the development of the sentence and the extent of vocabulary in young children. *U. Ia. Stud. child Welf.*, 1926, **3,** No. 5.

Stoner, Winifred S. *Natural education.* Indianapolis: Bobbs-Merrill, 1914.

Stoner, Winifred S. *Manual of natural education.* Indianapolis: Bobbs-Merrill, 1916.

Strayer, Lois C. Language and growth: The relative efficacy of early and deferred vocabulary training, studied by the method of co-twin control. *Genet. psychol. Monogr.*, 1930, **8,** 215–317.

Terman, L. M. The intelligence quotient of Francis Galton in childhood. *Amer. J. Psychol.*, 1917, **28,** 208–215.

Terman, L. M. An experiment in infant education. *J. appl. Psychol.*, 1918, **2,** 219–228.

Terman, L. M. The possibilities and limitations of training. *J. educ. Res.*, 1924, **10,** 335–343.

Van Alstyne, Dorothy. The environment of three-year-old children: Factors related to intelligence and vocabulary tests. *Teachers Coll. Contr. Educ.*, 1929, No. 366.

Washburne, C. When should we teach arithmetic? A committee of seven investigators. *Elem. sch. J.*, 1928, **28,** 659–665.

Wellman, Beth L. IQ changes of preschool and nonpreschool groups during the preschool years: A summary of the literature. *J. Psychol.*, 1945, **20,** 347–368.

Wellman, Beth L., & McCandless, B. R. Factors associated with Binet IQ changes of preschool children. *Psychol. Monogr.*, 1946, **60**(2, Whole No. 278).

Whipple, G. M. (Ed.) Nature and nurture. *Yearb. Nat. Soc. Stud. Educ.*, 1928, **27,** Parts 1 & 2.

Whipple, G. M. (Ed.) Intelligence: Its nature and nurture. *Yearb. Nat. Soc. Stud. Educ.*, 1940, **39,** Parts 1 & 2.

Wiener, N. *Ex-prodigy: My childhood and youth.* New York: Simon & Schuster, 1953.

Williams, Rath M., & Mattson, Marion L. The effect of social groupings upon the language of preschool children. *Child Develpm.*, 1942, **13,** 233–248.

Witte, K. *The education of Karl Witte.* (Ed. by H. A. Bruce & trans. by L. Wiener) New York: Crowell, 1914.

Woodworth, R. S. Heredity and environment: A critical survey of recently published material on twins and foster children. *Soc. Sci. Res. Council Bull.*, 1941, No. 47.

2.

Conditioned Emotional Reactions*

John B. Watson and Rosalie Rayner

In recent literature various speculations have been entered into concerning the possibility of conditioning various types of emotional response, but direct experimental evidence in support of such a view has been lacking. If the theory advanced by Watson and Morgan[1] to the effect that in infancy the original emotional reaction patterns are few, consisting so far as observed of fear, rage and love, then there must be some simple method by means of which the range of stimuli which can call out these emotions and their compounds is greatly increased. Otherwise, complexity in adult response could not be accounted for. These authors without adequate experimental evidence advanced the view that this range was increased by means of conditioned reflex factors. It was suggested there that the early home life of the child furnishes a laboratory situation for establishing conditioned emotional responses. The present authors have recently put the whole matter to an experimental test.

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* From J. B. Watson and R. Rayner, Conditioned emotional reactions, *J. exp. Psychol.*, **3,** 1–14 (1920). Reprinted by permission of the American Psychological Association.

Experimental work has been done so far on only one child, Albert B. This infant was reared almost from birth in a hospital environment; his mother was a wet nurse in the Harriet Lane Home for Invalid Children. Albert's life was normal: he was healthy from birth and one of the best developed youngsters ever brought to the hospital, weighing twenty-one pounds at nine months of age. He was on the whole stolid and unemotional. His stability was one of the principal reasons for using him as a subject in this test. We felt that we could do him relatively little harm by carrying out such experiments as those outlined below.

At approximately nine months of age we ran him through the emotional tests that have become a part of our regular routine in determining whether fear reactions can be called out by other stimuli than sharp noises and the sudden removal of support. Tests of this type have been described by the senior author in another place.[2] In brief, the infant was confronted suddenly and for the first time successively with a white rat, a rabbit, a dog, a monkey, with masks with and without hair, cotton wool, burning newspapers, etc. A permanent record of Albert's reactions to these objects and situations has been preserved in a motion picture study. Manipulation was the most usual reaction called out. *At no time did this infant ever show fear in any situation.* These experimental records were confirmed by the casual observations of the mother and hospital attendants. No one had ever seen him in a state of fear and rage. The infant practically never cried.

Up to approximately nine months of age we had not tested him with loud sounds. The test to determine whether a fear reaction could be called out by a loud sound was made when he was eight months, twenty-six days of age. The sound was that made by striking a hammer upon a suspended steel bar four feet in length and three-fourths of an inch in diameter. The laboratory notes are as follows:

> One of the two experimenters caused the child to turn its head and fixate her moving hand; the other, stationed back of the child, struck the steel bar a sharp blow. The child started violently, his breathing was checked and the arms were raised in a characteristic manner. On the second stimulation the same thing occurred, and in addition the lips began to pucker and tremble. On the third stimulation the child broke into a

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[1] "Emotional Reactions and Psychological Experimentation," *American Journal of Psychology*, April, 1917, Vol. 28, pp. 163–174.

[2] "Psychology from the Standpoint of a Behaviorist," p. 202.

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sudden crying fit. This is the first time an emotional situation in the laboratory has produced any fear or even crying in Albert.

We had expected just these results on account of our work with other infants brought up under similar conditions. It is worth while to call attention to the fact that removal of support (dropping and jerking the blanket upon which the infant was lying) was tried exhaustively upon this infant on the same occasion. It was not effective in producing the fear response. This stimulus is effective in younger children. At what age such stimuli lose their potency in producing fear is not known. Nor is it known whether less placid children ever lose their fear of them. This probably depends upon the training the child gets. It is well known that children eagerly run to be tossed into the air and caught. On the other hand it is equally well known that in the adult fear responses are called out quite clearly by the sudden removal of support, if the individual is walking across a bridge, walking out upon a beam, etc. There is a wide field of study here which is aside from our present point.

The sound stimulus, thus, at nine months of age, gives us the means of testing several important factors. I. Can we condition fear of an animal, e.g., a white rat, by visually presenting it and simultaneously striking a steel bar? II. If such a conditioned emotional response can be established, will there be a transfer to other animals or other objects? III. What is the effect of time upon such conditioned emotional responses? IV. If after a reasonable period such emotional responses have not died out, what laboratory methods can be devised for their removal?

I. The establishment of conditioned emotional responses. At first there was considerable hesitation upon our part in making the attempt to set up fear reactions experimentally. A certain responsibility attaches to such a procedure. We decided finally to make the attempt, comforting ourselves by the reflection that such attachments would arise anyway as soon as the child left the sheltered environment of the nursery for the rough and tumble of the home. We did not begin this work until Albert was eleven months, three days of age. Before attempting to set up a conditioned response we, as before, put him through all of the regular emotional tests. *Not the slightest sign of a fear response was obtained in any situation.*

The steps taken to condition emotional responses are shown in our laboratory notes.

11 Months 3 Days

1. White rat suddenly taken from the basket and presented to Albert. He began to reach for rat with left hand. Just as his hand touched the animal the bar was struck immediately behind his head. The infant jumped violently and fell forward, burying his face in the mattress. He did not cry, however.

2. Just as the right hand touched the rat the bar was again struck. Again the infant jumped violently, fell forward and began to whimper.

In order not to disturb the child too seriously no further tests were given for one week.

11 Months 10 Days

1. Rat presented suddenly without sound. There was steady fixation but no tendency at first to reach for it. The rat was then placed nearer, whereupon tentative reaching movements began with the

right hand. When the rat nosed the infant's left hand, the hand was immediately withdrawn. He started to reach for the head of the animal with the forefinger of the left hand, but withdrew it suddenly before contact. It is thus seen that the two joint stimulations given the previous week were not without effect. He was tested with his blocks immediately afterwards to see if they shared in the process of conditioning. He began immediately to pick them up, dropping them, pounding them, etc. In the remainder of the tests the blocks were given frequently to quiet him and to test his general emotional state. They were always removed from sight when the process of conditioning was under way.

2. Joint stimulation with rat and sound. Started, then fell over immediately to right side. No crying.

3. Joint stimulation. Fell to right side and rested upon hands, with head turned away from rat. No crying.

4. Joint stimulation. Same reaction.

5. Rat suddenly presented alone. Puckered face, whimpered and withdrew body sharply to the left.

6. Joint stimulation. Fell over immediately to right side and began to whimper.

7. Joint stimulation. Started violently and cried, but did not fall over.

8. Rat alone. *The instant the rat was shown the baby began to cry. Almost instantly he turned sharply to the left, fell over on left side, raised himself on all fours and began to crawl away so rapidly that he was caught with difficulty before reaching the edge of the table.*

This was as convincing a case of a completely conditioned fear response as could have been theoretically pictured. In all seven joint stimulations were given to bring about the complete reaction. It is not unlikely had the sound been of greater intensity or of a more complex clang character that the number of joint stimulations might have been materially reduced. Experiments designed to define the nature of the sounds that will serve best as emotional stimuli are under way.

II. When a conditioned emotional response has been established for one object, is there a transfer? Five days later Albert was again brought back into the laboratory and tested as follows:

11 Months 15 Days

1. Tested first with blocks: He reached readily for them, playing with them as usual. This shows that there has been no general transfer to the room, table, blocks, etc.

2. Rat alone. Whimpered immediately, withdrew right hand and turned head and trunk away.

3. Blocks again offered. Played readily with them, smiling and gurgling.

4. Rat alone. Leaned over to the left side as far away from the rat as possible, then fell over, getting up on all fours and scurrying away as rapidly as possible.

5. Blocks again offered. Reached immediately for them, smiling and laughing as before.

The above preliminary test shows that the conditioned response to the rat had carried over completely for the five days in which no tests were given. The question as to whether or not there is a transfer was next taken up.

6. Rabbit alone. The rabbit was suddenly placed on the mattress in front of him. The reaction was pronounced. Negative responses began at once. He leaned as far away from the animal as possible, whimpered, then burst into tears. When the rabbit was placed in contact with him he buried his face in the mattress, then

got up on all fours and crawled away, crying as he went. This was a most convincing test.

7. The blocks were next given him, after an interval. He played with them as before. It was observed by four people that he played far more energetically with them than ever before. The blocks were raised high over his head and slammed down with a great deal of force.

8. Dog alone. The dog did not produce as violent a reaction as the rabbit. The moment fixation occurred the child shrank back and as the animal came nearer he attempted to get on all fours but did not cry at first. As soon as the dog passed out of his range of vision he became quiet. The dog was then made to approach the infant's head (he was lying down at the moment). Albert straightened up immediately, fell over to the opposite side and turned his head away. He then began to cry.

9. The blocks were again presented. He began immediately to play with them.

10. Fur coat (seal). Withdrew immediately to the left side and began to fret. Coat put close to him on the left side, he turned immediately, began to cry and tried to crawl away on all fours.

11. Cotton wool. The wool was presented in a paper package. At the end the cotton was not covered by the paper. It was placed first on his feet. He kicked it away but did not touch it with his hands. When his hand was laid on the wool he immediately withdrew it but did not show the shock that the animals or fur coat produced in him. He then began to play with the paper, avoiding contact with the wool itself. He finally, under the impulse of the manipulative instinct, lost some of his negativism to the wool.

12. Just in play W. put his head down to see if Albert would play with his hair. Albert was completely negative. Two other observers did the same thing. He began immediately to play with their hair. W. then brought the Santa Claus mask and presented it to Albert. He was again pronouncedly negative. . . .

From the above results it would seem that emotional transfers do take place. Furthermore it would seem that the number of transfers resulting from an experimentally produced conditioned emotional reaction may be very large. In our observations we had no means of testing the complete number of transfers which may have resulted. . . .

IV. "Detachment" or removal of conditioned emotional responses. Unfortunately Albert was taken from the hospital the day the above tests were made. Hence the opportunity of building up an experimental technique by means of which we could remove the conditioned emotional responses was denied us. Our own view, expressed above, which is possibly not very well grounded, is that these responses in the home environment are likely to persist indefinitely, unless an accidental method for removing them is hit upon. The importance of establishing some method must be apparent to all. Had the opportunity been at hand we should have tried out several methods, some of which we may mention. (1) Constantly confronting the child with those stimuli which called out the responses in the hopes that habituation would come in corresponding to "fatigue" of reflex when differential reactions are to be set up. (2) By trying to "recondition" by showing objects calling out fear responses (visual) and simultaneously stimulating the erogenous zones (tactual). We should try first the lips, then the nipples and as a final resort the sex organs. (3) By trying to "recondition" by feeding the subject candy or other food just as the animal is shown. This method calls for the food control of the subject. (4) By building up "constructive" activities around the object by imitation and by putting the hand through the motions of manipulation. At this age imitation of overt motor activity is strong, as our present but unpublished experimentation has shown.

Incidental Observations . . .

The Freudians twenty years from now, unless their hypotheses change, when they come to analyze Albert's fear of a seal skin coat—assuming that he comes to analysis at that age—will probably tease from him the recital of a dream which upon their analysis will show that Albert at three years of age attempted to play with the pubic hair of the mother and was scolded violently for it. (We are by no means denying that this might in some other case condition it.) If the analyst has sufficiently prepared Albert to accept such a dream when found as an explanation of his avoiding tendencies, and if the analyst has the authority and personality to put it over, Albert may be fully convinced that the dream was a true revealer of the factors which brought about the fear.

It is probable that many of the phobias in psychopathology are true conditioned emotional reactions either of the direct or the transferred type. One may possibly have to believe that such persistence of early conditioned responses will be found only in persons who are constitutionally inferior. Our argument is meant to be constructive. Emotional disturbances in adults cannot be traced back to sex alone. They must be retraced along at least three collateral lines—to conditioned and transferred responses set up in infancy and early youth in all three of the fundamental human emotions.

3.

Single and Multiple Schedules of Reinforcement in Developmentally Retarded Children*[1]

Robert Orlando and Sidney W. Bijou[2]

Free-operant conditioning methods are being used with increasing frequency in a wide range of research applications with human subjects. Although some of the schedules of reinforcement which are of central importance in this kind of research have been systematically evaluated with infrahuman organisms (Ferster & Skinner, 1957), as yet few studies bear directly on questions of generality, variability, and special effects of schedule control in human Ss (Bijou, 1958; Ellis, Barnett, & Pryer, 1960; Green, Sanders, & Equier, 1959; Holland, 1957; Holland, 1958; Long, Hammack, May, & Campbell, 1958). Aside from academic issues involved in assumptions that infrahuman data provide sufficient bases for application in human behavior (Beach, 1960) and the need for genuine comparative and developmental data, practical research problems arise. Typically, extensive "trying out" of schedule types and values is necessary to find appropriate rate, pause distribution, resistance to extinction, and other features of free-operant behavior for studies using human Ss. The results of these time-consuming preliminary investigations are potentially valuable for other researchers because they provide empirical foundation for the selection of schedules with maximum sensitivity and control.

The purpose of the present paper is to show characteristic performances under four basic schedules (VI, FI, VR, and FR) and two multiple schedules (mult VR ext and mult CRF ext) in human Ss, and to illustrate some of the range and variability of these features in a population of institutionalized developmen-

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* From R. Orlando and S. W. Bijou, Single and multiple schedules of reinforcement in developmentally retarded children, *J. exp. anal. Behav.*, **3,** 339–348 (1960). Reprinted by permission of the authors and the *Journal of the Experimental Analysis of Behavior*.

[1] This investigation was supported by a grant (M-2232) from the National Institute of Mental Health, Public Health Service.

[2] The authors wish to express their gratitude for the support and assistance of Dr. Wesley D. White, Superintendent of the Rainier School, Buckley, Washington, and to Mr. Russell M. Tyler and Mr. David A. Marshall, who served as Research Assistants.

tally retarded children.[3] However, we did not attempt to demonstrate the full range of possible schedule values or limiting conditions and thresholds. Examples are from schedules that have proven useful in the study of retarded children.

Method

SUBJECTS

The Ss were 46 institutionalized retarded children ranging in CA from 9 to 21 and in IQ from 23 to 64. They were in residence from 1 to 16 years. Diagnostic categories included mongoloid, epileptic, familial, and others; and all were ambulatory. They came on request to the reception room of the laboratory from residence halls, classrooms, or work assignments.

All Ss had previously taken part in a study exploring a technique for the rapid establishment of multiple-schedule performance in the same experimental situation. Instructions, types of reinforcements, intersession intervals, and other conditions were the same for all Ss.

APPARATUS

The Ss were placed by themselves in an 8- by 10-foot room furnished with two chairs and a small table. The table, fixed to the wall next to a one-way observation window, contained a sturdy wooden response box and a chute for receiving reinforcers dispensed by a Gerbrands Universal Feeder mounted on the other side of the wall. The 12- by 16- by 12-inch response box was equipped with a 3-inch metal press-to-manipulate lever (handle grip for the squeezer of an O-Cedar sponge mop). This lever had a 4-inch vertical travel, and about a 150-gram pressure was necessary to operate it. Two colored jewel lights on the same front panel of the box and a buzzer inside could be used for various stimulus events.

Automatic equipment in an adjoining room provided remote control and recording operations. This consisted of electrical circuits, timers, tape-programmers, and cumulative recorders similar to those used with infrahuman Ss (Ferster & Skinner, 1957). A 300-watt frosted bulb in the center of the ceiling provided general illumination (in addition to sunlight from an airshaft-facing window), while a smaller bulb high over the response box served as a "bridge" by going out for 3 seconds following every reinforcement delivered *via* the chute.

The reinforcers were a mixture of commercially produced candies such as Hersheyettes, candy corn, M & M's, and mints. For most Ss, these candies were a highly coveted reward. (Many Ss traded candy to other children for pencils and small toys.)

PROCEDURE

Since all of the Ss had had previous experience in the situation, each session was preceded by minimal instructions: "Now it is your turn to get some candy. I'll be back when it is time to leave." Original instructions were: "Now it is your turn to get some of these (*E* shows a handful of candy). Come with me (ushers into the experimental room). Sit in this chair (in front of the apparatus). Now watch me; I'll show you how we get candy here (*E* presses lever five times at the rate of 2 per second, and the fifth response is reinforced). See? Here's candy for you. Now you do it. You get candy." (Then *E* leaves the room after *S* makes five independent responses and gets a reinforcement.) All sessions were terminated with, "That's all for today. Go and sit in the waiting room."

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[3] The term *developmentally* retarded is used in place of such terms as "feebleminded" and "mentally deficient." It is preferred because it is neutral with respect to etiology and avoids mentalistic implications. Furthermore, the term is descriptive and normative as noted by Cameron and Magaret (1951).

Sessions were 15 to 60 minutes, depending on the rate that reinforcers were earned, and typically were scheduled on a two-a-week basis. For those Ss who were shifted from one schedule to another, a criterion of no apparent change for two successive sessions was used before shift (i.e., essentially no change in over-all rate, number of reinforcers earned, duration and distribution of pauses, etc.).

Records were obtained on a Gerbrands Cumulative Recorder with paper speeds of 30 and 60 centimeters per hour and a reset number of 400 responses. With multiple schedules, type and duration of discriminative stimuli were recorded by a special events pen directly under the cumulative-response curve.

Results and Discussion

Figures 1 through 5 show the cumulative-response curves of selected Ss under a variety of schedules. These illustrate *representative* behaviors, and, in most of them, acquisition and transition stages have been omitted. When feasible and appropriate, segments have been collapsed on the abscissa to conserve space. (These may be identified by the absence of "reset" lines.) Each record is accompanied by *S* numbers (S-1, S-2, etc.), sessions numbers consecutive for each S, and schedules.

In Fig. 1 through 4, the paper speed of the recorder was 30 centimeters per hour. In Fig. 5, it was 30 centimeters per hour for Ss 11, 12, and 13, but 60 centimeters per hour for Ss 14 and 15.

VR

Like infrahuman Ss, retarded Ss produce high rates of responding under VR which are roughly proportional to the size of the ratio, while pauses are infrequent, short, and random with respect to time of reinforcement. Also, these characteristics appear to be rather resistant to change with shift of schedule.

These effects are illustrated in Fig. 1. After training on VR 100 (range 40 to 160), S-1 developed a very high rate with practically no pausing (Session 3). A shift to FR 25 (Session 4) did not result in any discriminable changes in this performance, although two DRL schedules (mult DRL 10 seconds in Session 5 and DRL 10 seconds in Session 6) brought the rate down somewhat. A comparatively lower rate was developed and maintained in S-2 (Sessions 3 to 6) on VR 25 (range 15 to 35). Upon being shifted to FR 25 in Session 7, only slight fixed-ratio-like post-reinforcement pauses emerged. These are shown in Sessions 8 and 10.

FR

The FR behavior is similar to that produced under VR in that high stable rates are common and higher rates are associated with lower (more responses per reinforcement) ratios; but pause distribution and durations are frequently different. Pauses (of greater duration than those associated with "consumatory" behavior) follow reinforcements, and the frequency of these pauses decreases as the ratio becomes lower.

The relationship between ratio size and

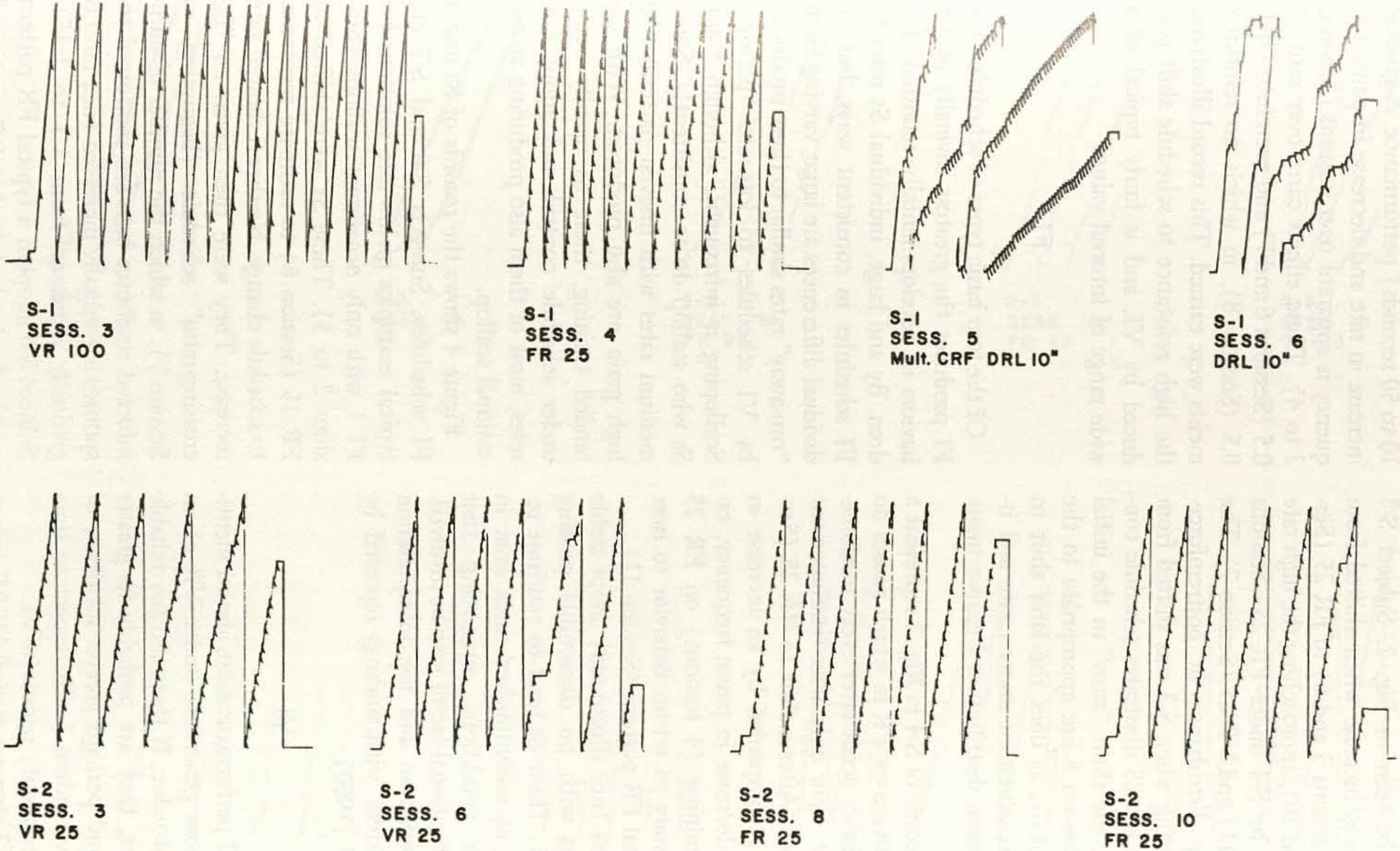

FIG. 1. Cumulative records showing VR performances and shifts to DRL and FR. Each session is identified by *S* number, session number, and schedule. From Orlando and Bijou: Single and multiple schedules of reinforcement in developmentally retarded children.

rate can be seen in Fig. 2. Subject S-3 shows a rate increase when shifted from FR 10 (Sessions 3 and 6) to FR 25 (Sessions 8 and 10), approaching the high rate exhibited by S-4 under FR 25 (Sessions 6, 9, and 11) and VR 25 (Session 7). The temporary disturbance in postreinforcement pausing when S-3 was shifted from FR 10 to FR 25 illustrates schedule control (e.g., the short "runs" in the initial part of Session 8 are appropriate to the smaller ratio), as does the later shift to VR 25, in which an uneven rate and irregular pause distribution become manifest.

The records of S-4 in Fig. 2 represent a typical pattern on FR in which pauses do not invariably occur after every reinforcement, but occur *only* after reinforcement (Session 6). After a shift to VR 25 (Session 7), accompanied by an increase in rate and decrease in pause frequency, extensive training (4 sessions) on FR 25 was necessary to return behavior to near the original FR pattern (Session 11).

Some *S*s (not illustrated) adopt stable high rates with no discernible pausing under FR. These *S*s tend to continue responding at undiminished rates even in extinction conditions, suggesting that some motivational factor may be involved. This observation and the interpretation are consistent with findings reported by Ellis *et al.* (1960).

VI

The VI performances are almost identical to those generated under VR of an equivalent value. If there are any reliable differences, they are probably in greater "grain" and perhaps greater incidence of essentially random (with respect to time of reinforcement) pauses in VI.

Figure 3 shows a typical VI 0.5 (range 10 to 50 seconds) performance. A gradual increase in rate and decrease in pause frequency is apparent over sessions (Sessions 2 to 4). These effects carry over into FI 0.5 (Sessions 6 and 7) and even into DRL 0.5 (Session 8), in which no reinforcements were earned. This record illustrates the high resistance to schedule shift produced by VI, and is fairly typical of a wide range of interval values.

FI

Of the four basic types of schedules, the FI produces the greatest diversity of behaviors in developmentally retarded children. By and large, individual *S*s react to FI schedules in consistent ways, but individual differences are large, varying from "run-away" rates similar to those produced by VI schedules to low-rate "pacing." Scalloping is infrequent, although those *S*s who scallop do so consistently. Some medium rates with uneven patterns and high grain are also produced. With extended training, these *S*s usually come under schedule control and adopt low rates, most of them also producing an occasional scallop.

Figure 4 shows the records of *S*s under FI schedules. Subjects S-6 and S-7 are typical examples of low-rate solutions for FI 1 with only occasional scallops (Sessions 2 to 5). These *S*s were shifted to FR 15 (Session 6) to estimate resistance to schedule change. Neither *S* showed rate increase. They were then given an "increasing-ratio" schedule (beginning in Session 7), in which the number of unreinforced responses between reinforced responses is gradually increased (i.e., ratio is gradually increased from 1:1 to 1:15). Subject S-6 adopted a typical FR pattern on the final schedule, but S-7 continued

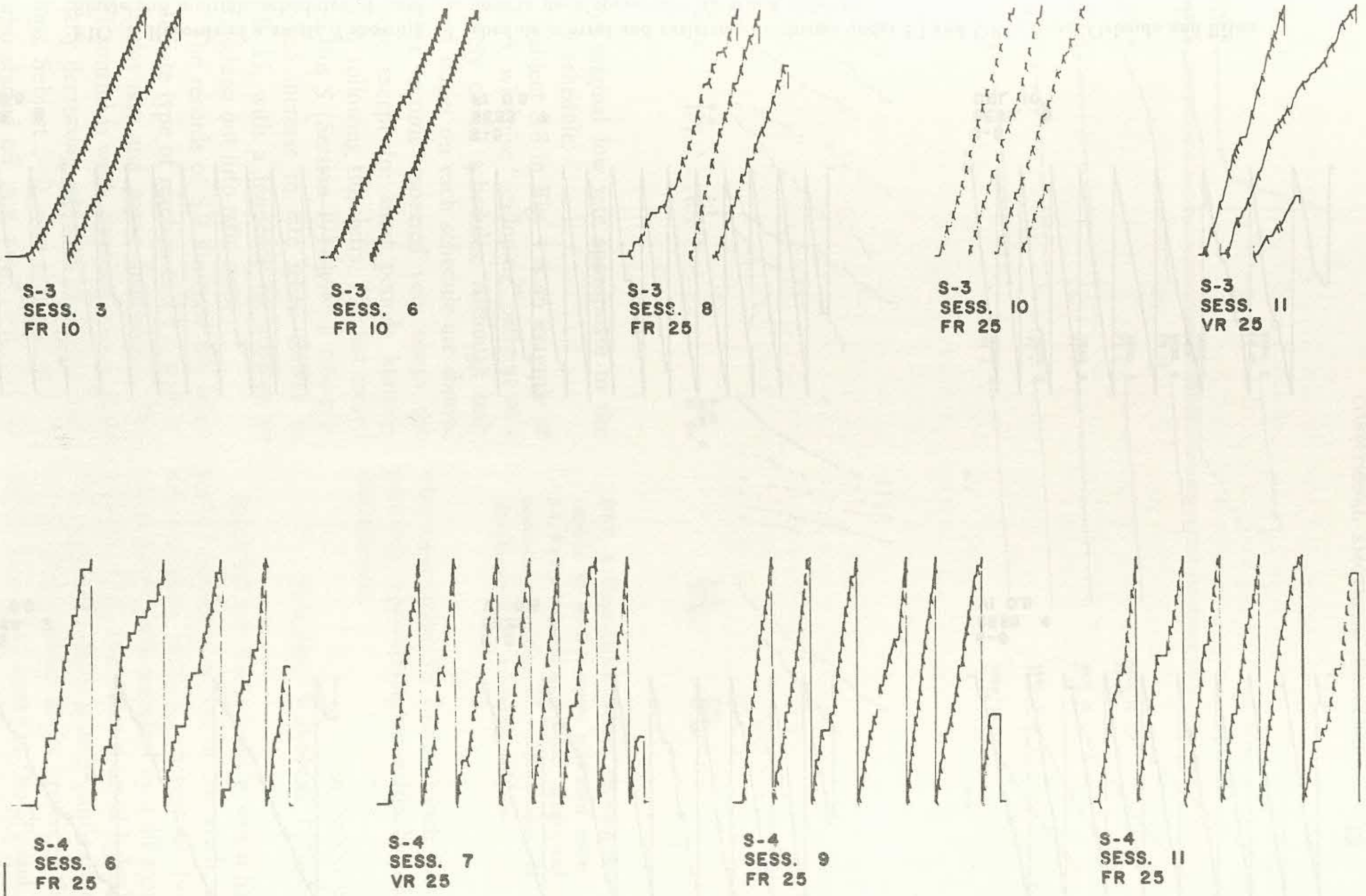

FIG. 2. Cumulative records showing FR performances and shifts to larger ratios and VR. From Orlando and Bijou: Single and multiple schedules of reinforcement in developmentally retarded children.

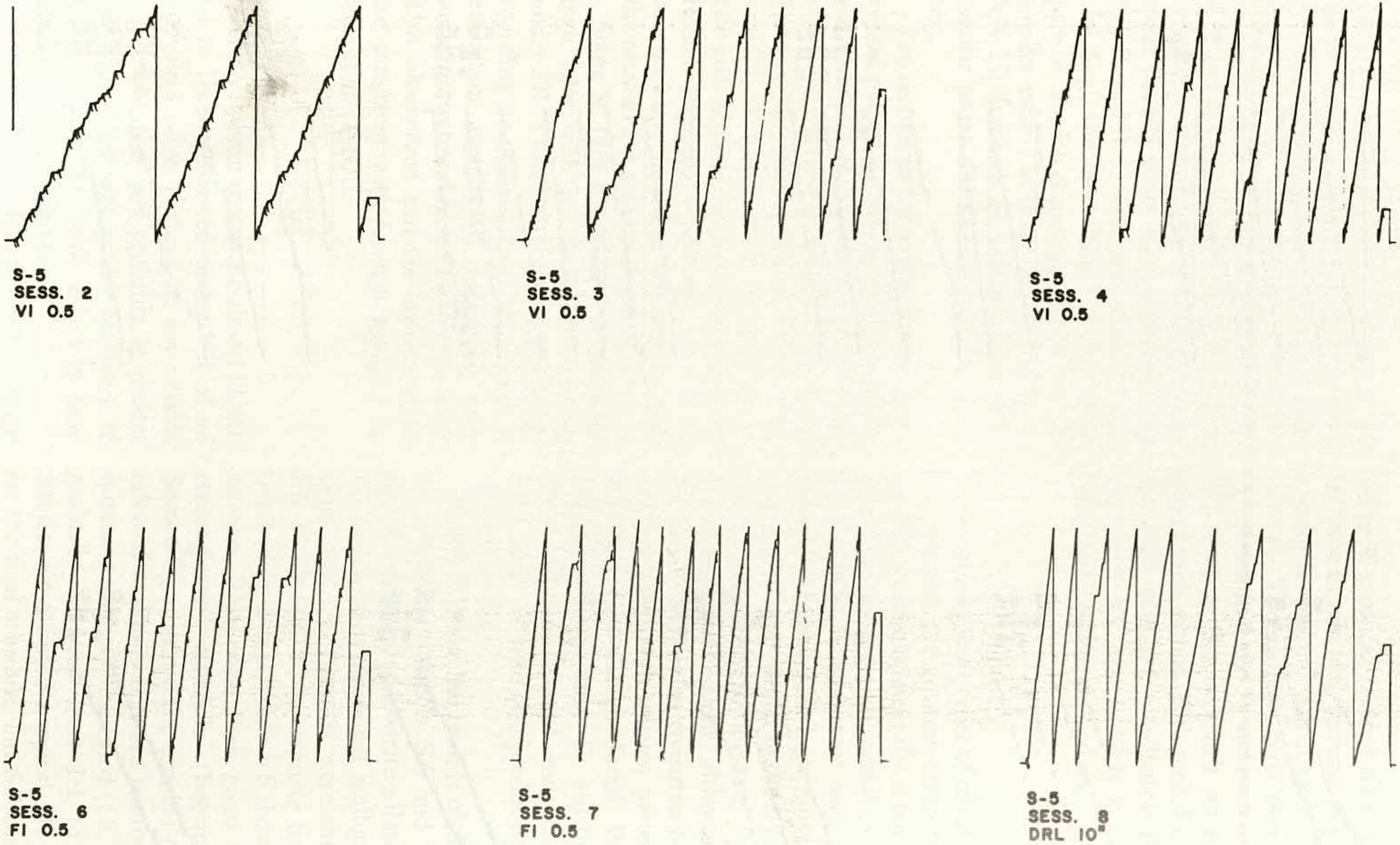

FIG. 3. Records of a single *S* showing VI schedule control and resistance to change under FI and DRL. From Orlando and Bijou: Single and multiple schedules of reinforcement in developmentally retarded children.

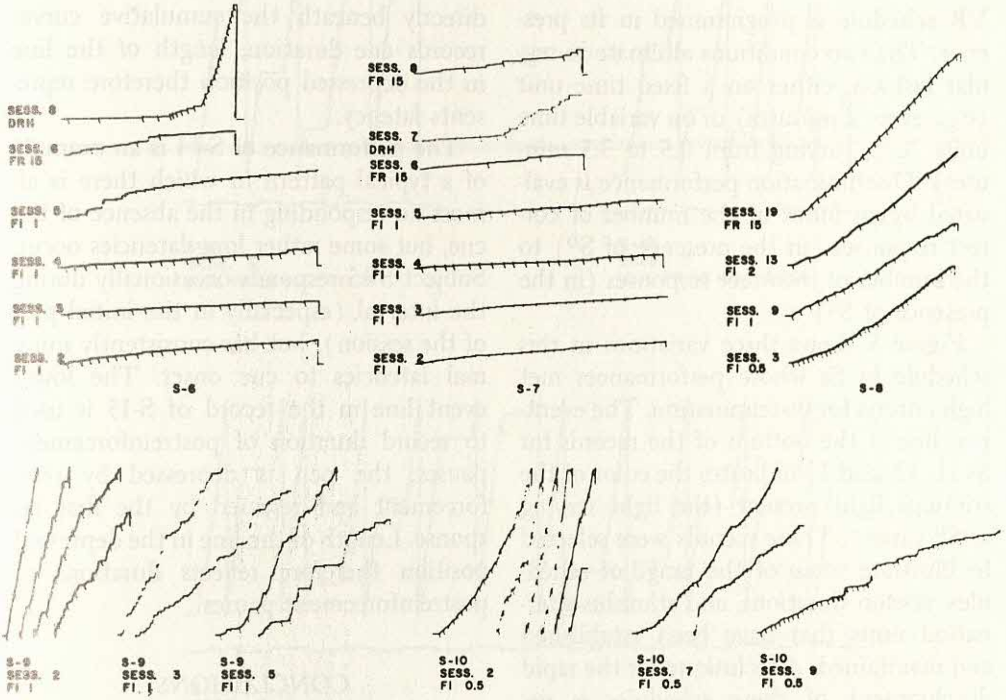

FIG. 4. Cumulative records showing the variety of performances produced under FI. From Orlando and Bijou: Single and multiple schedules of reinforcement in developmentally retarded children.

the original low rate appropriate to the FI 1 schedule.

Subject S-8 in Fig. 4 is an example of the Ss who give "scalloping" patterns on a variety of FI schedules. Although only final stages on each schedule are shown, other records appeared very much the same except for short periods immediately following the shifts. The last record for this S (Session 19) shows a ratio-produced increase in rate when shifted to FR 15, with a tendency for scallops to straighten out into ratio runs.

The records of S-9 illustrate the intermediate type of reaction to FI 1, with irregular rate and pause distribution. The FI control is weak, showing only in gradually decreasing rate and occasional scallops. Subject S-10 is an example of an S who started off very much like S-9, but who came under FI control much more positively, approaching an optimally low-rate solution.

MULTIPLE SCHEDULES

Mult VR ext. This schedule, which has proved especially useful in the study of discrimination learning, consists of two components, each signalled by a different stimulus (e.g., two colored jewel lights). One (e.g., red) serves as an S^{Δ}, and extinction is programmed in its presence; the other (e.g., blue) serves as the S^{D}, and a

VR schedule is programmed in its presence. The two conditions alternate in regular fashion, either on a fixed time unit (e.g., every 2 minutes) or on variable time units (e.g., varying from 0.5 to 3.5 minutes). Discrimination performance is evaluated by an index of the number of correct responses (in the presence of S^D) to the number of incorrect responses (in the presence of S^Δ).

Figure 5 shows three variations in this schedule in *S*s whose performances met high criteria for discrimination. The event-pen line at the bottom of the records for *S*s 11, 12, and 13 indicates the color of the stimulus light present (the light serving as S^D varies). These records were selected to illustrate some of the range of schedules, session durations, and stimulus-alternation units that have been established and maintained. A technique for the rapid development of these schedules is described in detail in another paper (Bijou & Orlando, in press).

Mult CRF ext. This multiple schedule is a simple variation of interval schedules in that a cue is added; that is, reinforcements are programmed in the same way as in interval schedules, but a cue is presented at the end of the interval. This cue is withdrawn with every reinforcement and re-presented after the required interval has again elapsed. Discrimination performance is evaluated by the extent to which the *S* refrains from responding in the absence of the cue and the latency of response after cue onset. A DRL component requiring that the *S* pause in the absence of the cue may be added as a further variation which develops precise stimulus control.

Figure 5 shows records of this schedule (mult CRF ext with fixed 0.5 interval) in two *S*s who met high criteria of discrimination (*S*s 14 and 15). The event-pen line directly beneath the cumulative curves records cue duration; length of the line in the depressed position therefore represents latency.

The performance of S-14 is an example of a typical pattern in which there is almost no responding in the absence of the cue, but some rather long latencies occur. Subject S-15 responds occasionally during the interval (especially in the initial part of the session), but has consistently minimal latencies to cue onset. The lower event line in the record of S-15 is used to record duration of postreinforcement pauses; the pen is depressed by reinforcement and released by the first response. Length of the line in the depressed position therefore reflects durations of postreinforcement pauses.

CONCLUSIONS

The distinctiveness of behaviors generated by each type of schedule certainly seems no less than in infrahuman *S*s, although individual differences within schedule types may have a greater range. Response rate is clearly a function of the kind and values of schedules (at least within the range represented here); higher rates are associated with lower ratios, longer intervals, and variable rather than fixed schedules. Pause distributions and durations, along with scalloping and other patterning effects, seem less reliably generated by schedule control. (For example, FR postreinforcement pauses are not always stable within or among *S*s.) Effects are in the expected direction, however. For example, postreinforcement pauses are more likely in FR than in VR, and more likely with higher ratios compared with lower ones.

Stability of schedule control is fairly good in retarded children. Few intrases-

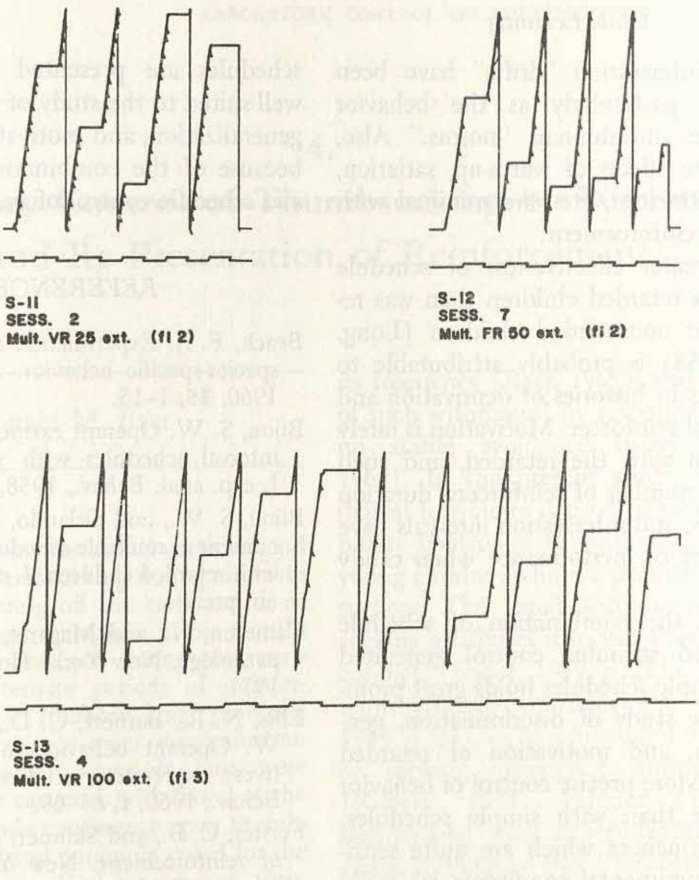

FIG. 5. Criterion sessions under two multiple schedules, showing variations in schedule values and performance. From Orlando and Bijou: Single and multiple schedules of reinforcement in developmentally retarded children.

sion or intersession "drifts" have been observed, particularly as the behavior approaches infrahuman "norms." Also, cumulative effects of warm-up, satiation, fatigue, boredom, etc., are minimal with candy as reinforcement.

The greater effectiveness of schedule control in retarded children than was reported for nonretarded children (Long, *et al.*, 1958) is probably attributable to differences in histories of deprivation and the type of reinforcer. Motivation is rarely a problem with the retarded, and such factors as number of reinforcers, duration of sessions, and intersession intervals have little effect on performance when candy is used.

Finally, the combination of schedule effects and stimulus control generated with multiple schedules holds great promise for the study of discrimination, generalization, and motivation of retarded children. More precise control of behavior is possible than with simple schedules, and performances which are quite sensitive to experimental conditions are easily obtained.

SUMMARY

Salient features of the behavior of developmentally retarded children as a function of simple and multiple schedules of reinforcement are illustrated. Effects of schedules are similar to those found with infrahuman *S*s as well as with nonretarded children. Two variations of multiple schedules are presented as particularly well-suited to the study of discrimination, generalization, and motivation in children because of the combination of stimulus and schedule control of performance.

REFERENCES

Beach, F. A. Experimental investigations of species-specific behavior. *Amer. Psychol.*, 1960, **15,** 1–18.

Bijou, S. W. Operant extinction after fixed-interval schedules with young children. *J. exp. anal. Behav.*, 1958, **1,** 25–29.

Bijou, S. W., and Orlando, R. Rapid development of multiple-schedule performances with retarded children. *J. exp. anal. Behav.* (in press).

Cameron, N., and Magaret, Ann. *Behavior pathology*. New York: Houghton Mifflin, 1951.

Ellis, N. R., Barnett, C. D., and Pryer, M. W. Operant behavior in mental defectives: exploratory studies. *J. exp. anal. Behav.*, 1960, **1,** 63–69.

Ferster, C. B., and Skinner, B. F. *Schedules of reinforcement*. New York: Appleton-Century-Crofts, 1957.

Green, E. J., Sanders, R. M., and Squier, R. W., Jr. Schedules of reinforcement and discrimination learning. *J. exp. anal. Behav.*, 1959, **2,** 293–299.

Holland, J. G. Technique for behavioral analysis of human observing. *Science*, 1957, **125,** 348–350.

Holland, J. G. Human vigilance. *Science*, 1958, **128,** 61–63.

Long, E. R., Hammack, J. T., May, F., and Campbell, B. J. Intermittent reinforcement of operant behavior in children. *J. exp. anal. Behav.*, 1958, **1,** 315–339.

4.

Laboratory Control of Thumbsucking by Withdrawal and Re-Presentation of Reinforcement*[1]

Donald M. Baer

A 5-year-old boy was shown cartoons, and punished for thumbsucking during alternate cartoons by turning off the cartoons for as long as his thumb remained in his mouth. Thumbsucking weakened during such periods. During alternate periods of uninterrupted cartoons, thumbsucking promptly recovered, suggesting a quick discrimination process. Two other 5-year-old boys were shown the same cartoons; withdrawal of the cartoons was made contingent upon thumbsucking for one, and randomly yoked for the other. Then their roles were reversed. Contingent withdrawal and re-presentation of the cartoons controlled thumbsucking rate; yoked withdrawal and re-presentation did not.

Positive reinforcement may be withdrawn from young children by showing them movie cartoons and programming interruptions of both picture and sound track. Making such withdrawal contingent upon a response effectively reduces its frequency (Baer, 1961); and the delay of such withdrawal by responding can set up stable avoidance behavior (Baer, 1960). In the present study, this withdrawal technique is used to produce temporary control of thumbsucking in three young children who are persistent thumbsuckers. The usual account of thumbsucking attributes it to inner tensions and conflicts (Spock, 1959, p. 211), to its self-reinforcement consequences (Fenichel, 1954, p. 63), or to a history of deprivation of sucking experience during infancy (Roberts, 1944). Palermo (1956) has summarized what experimental evidence exists, and argued that thumbsucking may be interpreted as a learned response which reduces anxiety. In this context, it would seem valuable to show to what extent thumbsucking may be modified by current environmental control, using explicit stimulus consequences of the response.

Procedure

The first S was a 5-year-old boy from a local nursery school, who had seen the same three cartoons each session, for eight sessions separated from one another by 2

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* From D. M. Baer, Laboratory control of thumbsucking by withdrawal and re-presentation of reinforcement, *J. exp. anal. Behav.*, **5**, 525–528 (1962). Reprinted by permission of the author and the *Journal of the Experimental Analysis of Behavior.*

[1] This study was supported by U.S. Public Health Service Grant M-2208. The author is grateful to Mrs. Anne Pilisdorf for her intelligent and reliable performance as A.

or 3 days. He showed great enjoyment, laughing and mumbling throughout, and also sucked his thumb virtually 100% of each 21-min session. During these eight preliminary sessions, the subject had seen the cartoons without interruption or any other experimental treatment. (A bar was located close to his right hand for collecting an extensive operant level; however, the operant level of bar pressing was zero throughout all of these sessions.) Thus, S was well adapted, but experimentally naive.

The general procedure was identical to that described in an earlier paper (Baer, 1960). The *S* was conducted to the experimental room by a young female adult, A, who seated him before a movie screen built into one wall of the room. She then sat behind a partition in a corner of the room. Cartoons were projected on the screen from the experimenter's control and observation room on the other side of the wall. During each of the eight preliminary sessions, three 7-min cartoons were shown without break or interruption. During each of the three experimental sessions reported here, S was shown the same three cartoons twice, without any break between cartoons, in the sequence A, B, C, A, B, C. Thumbsucking was recorded on a Gerbrands cumulative recorder which stepped one response for every three cumulative seconds of thumbsucking. Observing through a one-way mirror, the experimenter held down a key on an otherwise automatic programmer whenever *S*'s thumb was in his mouth. The programmer pulsed the recorder for every 3 sec the key was depressed. Under punishment conditions, the programmer turned off the projector lamp and opened the loudspeaker's voice coil as long as the key was depressed so that sight and sound of the cartoons were withdrawn.

During the experimental sessions, *S* was shown cartoon A without punishment; was punished for all thumbsucking during B (a Control period); allowed C as a Recovery period; punished again for all thumbsucking during the second (Control) showing of A; allowed the second showing of B as a Recovery period; and punished again for all thumbsucking during the second (Control) showing of C.

RESULTS AND DISCUSSION

Cumulative thumbsucking for the three experimental sessions is shown in Fig. 1 (a photographic reproduction of a tracing of the original record). The paper speed in the recorder was 22 in. per hr; thus, maximum slope was not steep. (Note the "maximum possible rate" in the figure.) During the first showing of A in each session (operant level), the rate of thumbsucking was very nearly maximal. For the first session, recovery during C was equal to the level established during A, but recovery during the second showing of B was less. However, during the second and third sessions, recovery was typically strong and prompt. The pattern was similar for responses under the Control conditions. During the first session, succeeding Control periods were progressively more effective in decreasing rate; during the second and third sessions, the rate was quite uniformly and effectively lowered during all Control conditions.

The *S* left after seeing only four cartoons during the third session, saying he had "seen enough." This may be attributed to the periods of punishment undergone. On the other hand, it should be recalled that S had seen each cartoon a

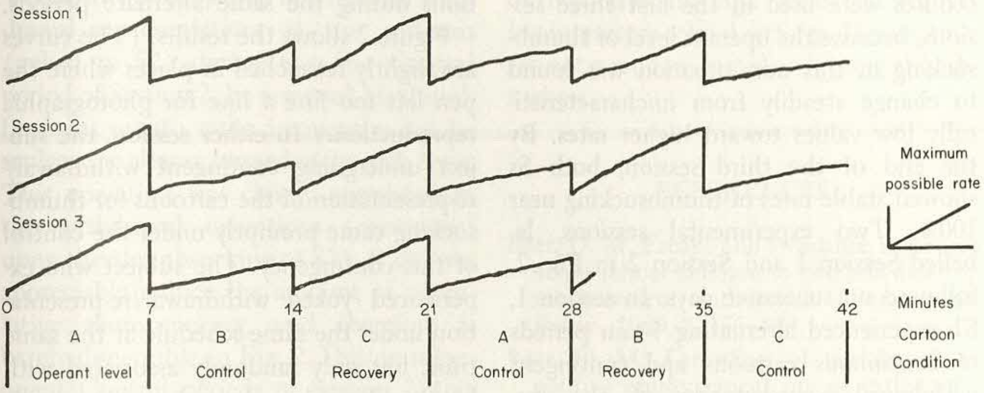

FIG. 1. Cumulative thumbsucking curves of a single subject under alternating conditions of Control and Recovery. From Baer: Laboratory control of thumbsucking by withdrawal and re-presentation of reinforcement.

total of 13 times, at 2- or 3-day intervals: satiation is not unreasonable, punishment or not.

The prompt and strong recovery of thumbsucking during the Recovery periods of the second and third sessions, coupled with the immediate weakening of the response during Control periods, may suggest a rapid process of discrimination of the schedule components, rather than a generalized suppression of thumbsucking through punishment. At any rate, the response remained weak only during punishment, a typical enough result. Further experimental manipulation was frustrated by the "graduation" of *S* from nursery school 1 week later.

The procedure used to establish this temporary control of the thumbsucking response was a complex one. It involved withdrawal of reinforcement; re-presentation of reinforcement; and the contingency of withdrawal for thumbsucking and re-presentation for removal of the thumb from the mouth. In an attempt to show the role of the contingent use of these operations, compared with their random or noncontingent use, two other 5-year-old boys were studied in a yoked situation.

In this situation, the two *S*s sat side by side and watched the same cartoons projected on the screen before them. A small room-divider was placed between them so that they could not observe each other as they watched the cartoons. Two observers watched the *S*s, each recording the thumbsucking of one *S* on separate cumulative recorders.[2] (The recorders were housed in boxes in a distant room, so that their clicking was inaudible to the *S*s or *E*s.) The *S*s were shown cartoons for a total of 30 min per session. No experimental procedures were used in the first three sessions, because the operant level of thumbsucking in this new situation was found to change steadily from uncharacteristically low values toward higher rates. By the end of the third session, both Ss showed stable rates of thumbsucking near 100%. Two experimental sessions, labelled Session 1 and Session 2 in Fig. 2, followed on successive days. In session 1, S1 experienced alternating 5-min periods of continuous cartoons and contingent withdrawal/re-presentation of the cartoons. And S2, sitting beside him and watching the same screen, hence had a yoked withdrawal/re-presentation of the cartoons during the same alternate intervals. However, in his case, these operations had only a random contingency with his thumbsucking behavior. The next day, during Session 2, the roles of S1 and S2 were reversed: S2 experienced alternating periods of continuous cartoons and contingent withdrawal/re-presentation, while S1 experienced the yoked, noncontingent withdrawal/re-presentation operations during the same alternate periods.

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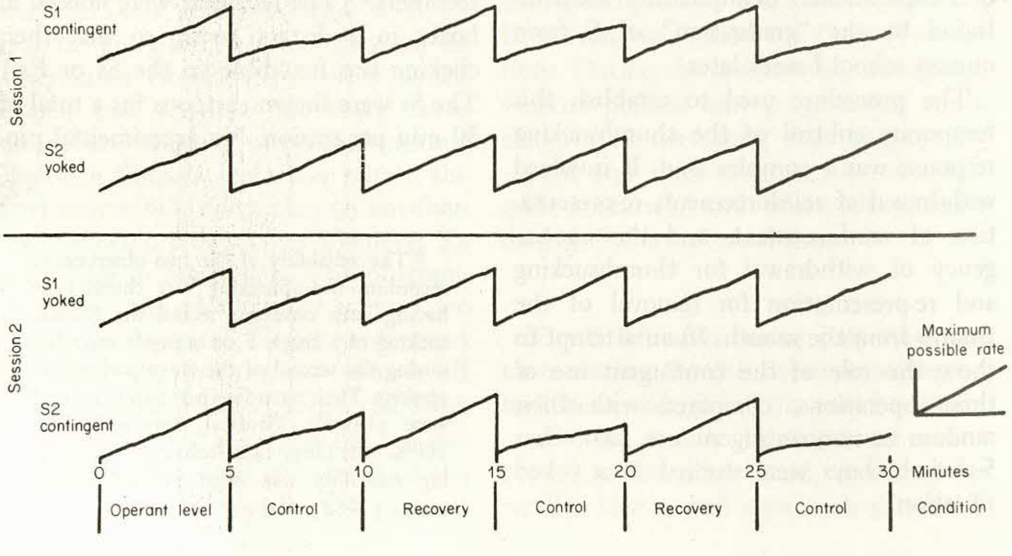
[2] The reliability of the two observers in recording thumbsucking was checked by having both observers record the thumbsucking of a single *S* on separate recorders during the second of the three preliminary sessions. Their records, when superimposed, were virtually identical, implying near-100% reliability. This technique for assessing reliability was suggested by Goldiamond (1962).

Figure 2 shows the results. (The curves are slightly retouched in places where the pen left too fine a line for photographic reproduction.) In either session, the subject undergoing contingent withdrawal/re-presentation of the cartoons for thumbsucking came promptly under the control of this contingency. The subject who experienced yoked withdrawal/re-presentation under the same schedule at the same time, but only randomly associated with his thumbsucking, showed no obvious effect. However, the observer did note a transitory exception to this pattern in S1 during Session 2. In the previous session, S1 had been subjected to contingent withdrawal/re-presentation for thumbsucking.

FIG. 2. Cumulative thumbsucking curves of two subjects, one experiencing contingent withdrawal/re-presentation and the other yoked, under alternating conditions of Control and Recovery. From Baer: Laboratory control of thumbsucking by withdrawal and re-presentation of reinforcement.



When S1 was subjected to a random withdrawal/re-presentation of the cartoons (yoked to S2) during the first Control period of Session 2, he removed his thumb from his mouth quite frequently; but he replaced it almost immediately each time. This operation was closely correlated to the withdrawal operations (contingent upon the thumbsucking of S2). It did not appreciably reduce the amount of cumulative thumbsucking, and therefore is barely discernible in Fig. 2. During subsequent Control periods of Session 2, this pattern of response virtually disappeared.

Hence, contingent withdrawal/re-presentation of the cartoons appears to weaken the thumbsucking response during periods when it is in effect; but random withdrawal/re-presentation operations of the same frequency, extent, and timing do not appreciably affect a thumbsucking response occurring at the same time.

No claims are made about the generality of this effect. The *S*s number three; all were boys; and all were chosen because of their unusually high rate of thumbsucking in nursery school settings. Hence, they are not a random sample of young thumbsuckers.

REFERENCES

Baer, D. M. Escape and avoidance responses of pre-school children to two schedules of reinforcement withdrawal. *J. exp. anal. Behav.*, 1960, **3,** 155–159.

Baer, D. M. The effect of withdrawal of positive reinforcement on an extinguishing response in young children. *Child Developm.*, 1961, **32,** 67–74.

Fenichel, O. *The psychoanalytic theory of the neuroses.* New York: Norton, 1945.

Goldiamond, I. The experimental analysis and control of fluent speech and stuttering. *J. Mathetics*, 1962, **1.**

Palermo, D. S. Thumbsucking: a learned response. *Pediatr.*, 1956, **17,** 392–399.

Roberts, E. Thumb and finger-sucking in relation to feeding in early infancy. *Am. J. Dis. Child.*, 1944, **68,** 7–8.

Spock, B. *The common sense book of baby and child care.* New York: Duell, Sloan and Pierce, 1957.

5.

An Operant-Discrimination Apparatus for Infants*[1]

Mae Williamson Simmons and
Lewis P. Lipsitt

Operant-conditioning and discrimination procedures have been used successfully with older children (Warren & Brown, 1943; Bijou, 1955; Long, 1959). Students of infant behavior have also adapted the operant procedure for the study of early-learning processes. Brackbill (1958) has conditioned a smiling response in 4-month-old babies, with contact stimulation as reinforcement; and Rheingold, Gewirtz, and Ross (1959) trained 3 monthers to vocalize, with auditory, tactual, and visual components as reinforcement.

This paper describes an operant technique that (a) uses manipulanda suitable to the response repertoire of infants; (b) provides a choice situation to enable the study of discriminative behavior; and (c) allows automatic recording of response frequency to different stimuli within time units.

Figure 1 is a [drawing] of the apparatus. It consists of two units: one contains the stimuli, manipulanda, and auditory-reinforcement sources; and the other contains the experimenter's remote-control switches. The child's unit is a rectangular box, shaped so that it rests on the playpen floor with the front panel sloping toward S. Two 6-inch white square insets are the manipulanda. In the center of each square is a 2-inch-diameter aperture of flashed opal glass; and behind each of these is a cluster of four colored (red, pink, blue, and yellow) bulbs, each activated independently. The manipulanda rest on microswitch leafs which allow them to be moved about 0.5 inch when tapped or banged. When a panel is moved, either the sound of chimes or no sound will occur, depending on the setting made by *E* at the remote unit, from which the stimulus lights are also controlled. From counters, *E* reads the cumulative frequency of responding to each panel every 30 seconds.

Data from two infants are reported here to exemplify the procedures used.

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* From M. W. Simmons and L. P. Lipsitt, An operant-discrimination apparatus for infants, *J. exp. anal. Behav.,* **4,** 233–235 (1961). Reprinted by permission of the authors and the *Journal of the Experimental Analysis of Behavior.*

[1] The development of this technique has been supported by the Institute for Health Sciences at Brown University, under a Public Health Service research grant (B-2356) from the National Institute of Neurological Diseases and Blindness. The writers are indebted to Dr. Glidden L. Brooks, Director of the Institute for Health Sciences, for his encouragement. Mr. Clement DeLucia constructed the apparatus.

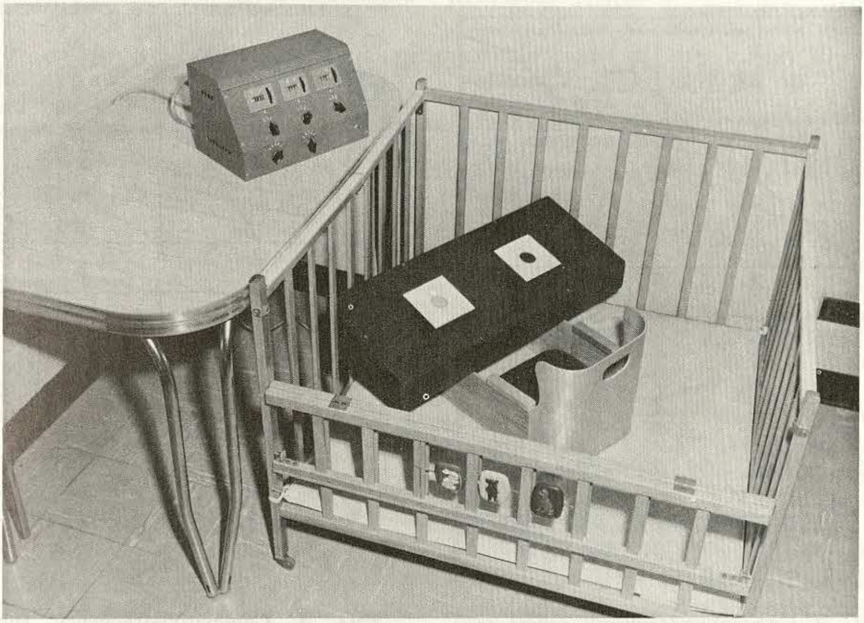

FIG. 1. The apparatus. From Simmons and Lipsitt: An operant-discrimination apparatus for infants.

Each experimental session lasted 8 minutes, divided into four 2-minute phases. In Phase 1, the positive stimulus (e.g., red light and chimes) occurs in the left panel, while the negative stimulus (e.g., blue light and no sound) occurs in the right. In Phase 2, the positive stimulus is switched to the right panel and the negative stimulus to the left panel. In Phase 3, both panels are negative; thus, a response to either panel produces no sound. In Phase 4, the positive stimulus is again associated with one of the panels and the negative stimulus with the other.

Figure 2 shows the data from one infant in a red-positive, blue-negative discrimination setting. The same data are plotted in two ways. The top graph is a continuous recording of responses to the left and right panels. In Phase 1, the child pushed the left positive panel with a greater frequency than the right negative panel. In Phase 2, where red and chimes were switched to the opposite panel, the child's relative frequency of responding to the two panels switched accordingly. In Phase 3, an extinction phase in which both panels are negative, the child tended to stop responding, particularly in the second minute of the interval. In Phase 4, a pattern of discriminative responding was restored, with almost no responses occurring to the negative panel. The bottom graph shows the same data, resetting the frequency curves at zero in each new phase. The data from the next subject are plotted in this manner in Fig. 3.

Figure 3 shows the data from another infant tested on two occasions separated by 3 days. On the first occasion, the discrimination was a red-positive, pink-negative one; on the second day, pink was

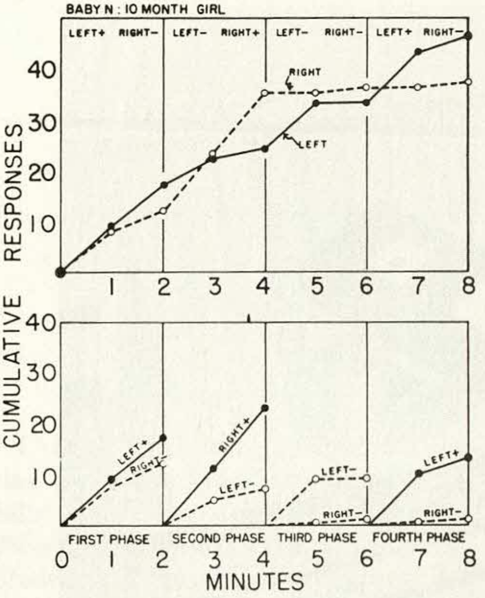

FIG. 2. **Cumulative-frequency curves to the two panels from a 10-month-old girl. The data in the bottom graph are replots of the data above. From Simmons and Lipsitt: An operant-discrimination apparatus for infants.**

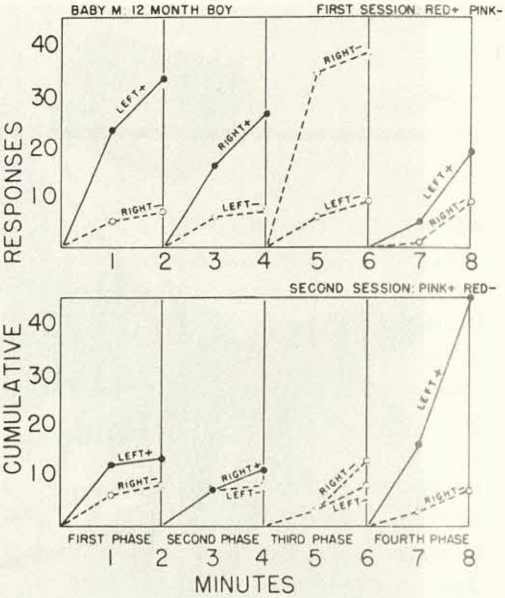

FIG. 3. **Cumulative-frequency curves from a 12-month-old boy on two different occasions. The positive stimulus was red on the first occasion and pink on the next. From Simmons and Lipsitt: An operant-discrimination apparatus for infants.**

associated with chimes and red was the negative stimulus. On the first day, the discrimination was readily established in Phase 1, and in Phase 2 the infant's behavior shifted appropriately. In Phase 3, this child produced more responses than in any other phase. This may represent an initial frustration reaction produced by the withdrawal of the previously positive stimulation. However, this reaction was short-lived and extinction behavior ensued. Responses decreased greatly in the second minute of that phase relative to the first. The bottom part of Fig. 3 shows the second session, in which pink was now the positive stimulus. In the first two phases, discriminative behavior was present but it was not so striking as on the first day; by the fourth phase, differential responding was clearly present.

The procedures described here offer a technique for the study of learning and discrimination processes in the human infant. Variations of these procedures may be used to assess the sensory capacities of the young child who is unable to verbally report perceived differences in paired stimuli.

REFERENCES

Bijou, S. W. A systematic approach to an experimental analysis of young children. *Child Develpm.*, 1955, **26,** 161–168.

Brackbill, Yvonne. Extinction of the smiling response in infants as a function of reinforcement schedule. *Child Develpm.*, 1958, **29,** 115–124.

Long, E. R. The use of operant conditioning techniques in children. In S. Fisher (Ed.), *Child research in psychopharmacology.* Springfield, Ill.: Charles C. Thomas, 1959. Pp. 111–124.

Rheingold, Harriet L., Gewirtz, J. L., and Ross, Helen W. Social conditioning of vocalizations in the infant. *J. comp. physiol. Psychol.*, 1959, **52,** 68–73.

Warren, A. B., and Brown, R. H. Conditioning operant response phenomena in children. *J. gen. Psychol.*, 1943, **28,** 181–207.

6.

Vicarious Reinforcement and Imitative Learning*[1]

Albert Bandura, Dorothea Ross,[2] *and Sheila A. Ross*

The present experiment was designed to study the influence of response-consequences to the model on the imitative learning of aggression. Nursery school children were assigned randomly to 1 of the following groups: aggressive model-rewarded; aggressive model-punished; a control group shown highly expressive but nonaggressive models; and a 2nd control group which had no exposure to models. The children were then tested for the incidence of post-exposure imitative and nonimitative aggressive responses. Children who witnessed the aggressive model rewarded showed more imitative aggression and preferred to emulate the successful aggressor than children in the aggressive model-punished group who both failed to reproduce his behavior and rejected him as a model for emulation. Control over aggression was vicariously transmitted to boys by the administration of aversive stimuli to the model, and to girls by the presentation of incompatible prosocial examples of behavior.

It is becoming increasingly apparent that social learning cannot be adequately explained in terms of direct reinforcement principles. New social responses may be acquired or the characteristics of existing response hierarchies may be considerably modified as a function of observing the behavior of others and its response consequences without the observer's performing any overt responses himself or receiving any direct reinforcement during the acquisition period (Bandura, 1962). The amount of learning exhibited by the observer can, in fact, be as great as that shown by the reinforced performer (McBrearty, Marston, & Kanfer, 1961). The study reported in this paper is one in a series of experiments of learning through imitation designed to bring a wider range of social learning phenomena within the scope of behavior theory.

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* From A. Bandura, D. Ross, and S. A. Ross, Vicarious reinforcement and imitative learning, mimeographed paper, 1962. Reprinted by permission of the authors.

[1] This investigation was supported by Research Grant M-5162 from the National Institutes of Health, United States Public Health Service. The authors wish to thank William Yabroff for his assistance with the photography, Jeffrey Eiseman and Joe Leonard for serving as models, and Marilyn Haley for her aid in arranging the research facilities.

[2] This Research was carried out while the junior author was the recipient of an American Association of University Women International Fellowship for postdoctoral research.

It is a common assumption in theorizing about vicarious or imitative learning that this mode of response acquisition is based essentially on a process of covert instrumental conditioning in which the observer acquires responses imitatively by performing covertly the behavior exhibited by a model (Logan, Olmstead, Rosner, Schwartz, & Stevens, 1955; Maccoby, 1959). It is further assumed that the occurrence of vicarious learning phenomena is contingent on the administration to the performing model reinforcing stimuli which the observer presumably experiences as vicarious reinforcements (Hill, 1960; Mowrer, 1960). Some evidence that direct and vicarious reinforcement may, in fact, function analogously is provided by studies demonstrating that when a model is punished in the presence of an observer, the latter acquires conditioned emotional responses even though he himself receives no aversive stimulation (Barnett & Benedetti, 1960; Berger, 1962; Haner & Whitney, 1960), and that vicariously conditioned fear responses mediate avoidance reactions or response inhibition (Walters, Leat, & Mezei, 1963). Similarly, observation of a model performing responses for which he is positively reinforced may be expected to produce disinhibition, and positive incentive learning in the observer, thus facilitating the occurrence of imitative behavior (Bandura & Walters, 1963; Mowrer, 1960). In order to test systematically the possible influence of vicarious reinforcement on imitative learning, an experiment was conducted in which imitation of aggression was studied as a function of rewarding and punishing consequences to the model.

Nursery school children were randomly assigned to one of the following groups: aggressive model-rewarded, aggressive model-punished, a control group shown highly expressive but nonaggressive models, and a second control group which had no exposure to the models. In accordance with the theory of vicarious reinforcement, it was predicted that children who observe a model amass highly desired reinforcers through aggressive behavior will display more imitative and nonimitative aggression than children who see the model punished for exhibiting aggressive responses. Evidence that mere exposure to aggressive models augments an observer's expression of aggression (Bandura, Ross, & Ross, 1961, 1963; Lövaas, 1961; Mussen & Rutherford, 1961; Walters, Llewellyn-Thomas, & Acker, 1962), suggests that the model-punished condition is likely to produce both eliciting and inhibitory effects and consequently, the outcome will be partly a function of which of the two effects predominate. Since, however, the model was administered relatively severe physical punishment, it was predicted that the model-punished group will display less nonimitative aggression and no more imitative aggressive responses than the control group children who had no exposure to aggressive models.

Method

SUBJECTS

The subjects were 40 boys and 40 girls drawn from the Stanford University Nursery School. They ranged from 38 to 63 months, with a mean age of 51 months.

The boys and girls were randomly assigned to one of the two experimental or control groups. The models were two adult males presented to the children by means of 5-minute film sequences projected on a glass lenscreen in a television console.

PROCEDURE

The experimenter met the child in the nursery school and invited him to play in her toy room. On the way to the room the experimenter informed the child that first she had to complete some paper work in another office during which time the child could watch a televised program. As they entered the office the experimenter seated the child and then ostensibly tuned in a program on the television console situated approximately 5 feet directly in front of the child. The experimenter occupied herself busily in a far corner of the room while the child viewed the filmed performance.

In the Aggressive Model-Rewarded condition, Rocky, the aggressive model, encounters Johnny who is playing with his highly attractive collection of toys. Rocky asks to play with some of the articles but is refused. He then exhibits the following sequence of aggressive responses: he strikes Johnny several times with a rubber ball; he kicks an inflated plastic doll about the room; and shoots darts at Johnny's cars and plastic farm animals. Following this display of aggression, Rocky stumbles as he steps over a pile of toys, Johnny sits on him and attempts to spank him but is quickly overpowered. Rocky then strikes Johnny with a baton, lassoes him with a hoola hoop, and pulls him forcefully to a far corner of the room. Throughout the filmed interaction, Rocky's aggressive acts were accompanied by numerous distinctive aggressive verbalizations. The final scene shows Johnny seated dejectedly in the corner while Rocky is playing with the toys, serving himself generous helpings of 7-Up and cookies, and riding a large bouncing hobby horse with gusto. As the scene closes, Rocky packs the playthings in a sack and sings a merry tune, "Hi ho, hi ho, it's off to play I go," as he departs with the hobby horse under his arm and the bulging sack of loot over his shoulder. A commentator's voice announces that Rocky is the victor.

The film shown to the children in the Aggressive Model-Punished condition was identical in all respects with the one presented to the model-rewarded group except that the social-interaction sequence was slightly rearranged so that the aggressive behavior shown by the model resulted in his being severely punished. The scene in which Johnny attempts to spank Rocky was inserted at the end of the film and extended so that Rocky is thoroughly thrashed by Johnny. As soon as he succeeds in freeing himself, Rocky flees to a corner of the room where he sits cowering, while Johnny places his toys in the sack and walks away. The announcer comments on Rocky's punishment.

Children in the Nonaggressive Model-Control group observed the two males engage in vigorous but nonaggressive play with the aggressive stimulus objects. Since observation of models playing actively with particular articles may reduce inhibitory responses and enhance the observer's interest in the same or similar stimulus objects, this control group provided a partial check on the influence of activity level and the stimulus enhancement factor (Crawford & Spence, 1939), on the performance of aggressive responses. The models in the control film threw the ball to each other by bouncing it off the wall;

they used the guns as a low hurdle in a jump game; they danced with the plastic doll, and rolled and twirled the baton and hoola hoop.

Children in the second control group had no prior exposure to models.

Test for Delayed Imitation

After observing the models, the children were tested in a different experimental situation designed to assess the incidence of post-exposure imitative and nonimitative aggressive responses. The experimental test room contained a baton, two 5-foot Bobo dolls, three balls, a hoola hoop, and a lasso, dart guns, cars, and plastic farm animals, all of which could be used by the children to reproduce the models' aggressive response patterns. A variety of toys which tend to elicit predominantly nonaggressive responses were also provided. These included a blackboard, a doll house equipped with furniture and a doll family, three cotton-stuffed dolls, and a set of building blocks. In order to control for any variation in behavior due to position of the stimulus objects in the room, the play material was arranged in a fixed order for each of the test sessions. It was necessary for the experimenter to remain in the room during the experimental session since the pretest revealed that the children exhibited some anxiety about being left alone in the room for a relatively long period of time and tended to leave before the termination of the session. However, the experimenter minimized any influence that her presence might have on the children's behavior by busying herself with paper work at a desk in the far corner with her back turned to the room and thereby avoided any interaction with the children.

Each child spent 20 minutes in the test room during which time his behavior was rated in terms of predetermined response categories by judges who observed the session through a one-way mirror in an adjoining observation room. The 20-minute session was subdivided into 5-second intervals by means of an electric timer, thus yielding a total number of 240 response units for each child.

One rater scored the test sessions for all 80 children. In order to provide an estimate of interscorer reliability, the responses of 11 children were scored independently by a second observer. Neither of the raters had knowledge of the treatment conditions to which the children were assigned. Since the raters simply recorded the frequency of occurrence of clearly defined specific classes of responses, interscorer reliabilities were high, the product-moment coefficients being in the .90s.

Response Measures

The measure of imitative aggression was obtained by counting the frequency with which the child performed the following matching responses: kicks the Bobo doll, lassoes it or strikes it with a ball or the baton, shoots darts at the cars or plastic farm animals; repeats the specific aggressive verbal responses emitted by the model. . . .

Model Preference

At the conclusion of the experiment each child who participated in treatment conditions utilizing models, was asked to evaluate the behavior exhibited by Rocky and Johnny, and to select the characters he preferred to emulate. The children's preferences for the two models served as an additional measure of the influence of response-consequences to the model in promoting imitation.

Results

The mean aggression scores for children in the experimental and the control groups are presented in Table 1. Since many of the children, particularly the girls, in the two control groups received zero or very low imitation scores, nonparametric techniques were employed to evaluate the significance of the obtained differences. Results of the Kruskal-Wallis analysis of variance performed on these scores reveal that imitation is significantly influenced by response-consequences to the model (Table 2). Further comparison

TABLE 1

Mean Aggression Scores for Children in the Experimental and Control Groups

	EXPERIMENTAL GROUPS		CONTROL GROUPS	
Response category	Aggressive model-rewarded	Aggressive model-punished	Non-aggressive model	No model
Imitative aggression	15.4	8.4	7.2	5.3
boys	16.2	7.8	10.0	5.6
girls	14.5	8.9	4.4	4.9
Nonimitative aggression	59.9	45.2	59.2	56.6
boys	75.6	45.6	81.7	62.0
girls	44.1	44.7	36.7	51.2
Total aggression	75.2	53.5	66.4	61.8
boys	91.8	53.4	91.7	67.6
girls	58.6	53.6	41.1	56.1

From Bandura, Ross and Ross: Vicarious reinforcement and imitative learning.

TABLE 2

Significance of the Differences between Experimental and Control Groups in Imitative Responses

			COMPARISON OF PAIRS OF TREATMENT CONDITIONS					
Response category	H	*p*	Rewarded versus punished *p*	Rewarded versus nonaggressive *p*	Rewarded versus control *p*	Punished versus nonaggressive *p*	Punished versus control *p*	Nonaggressive versus control *p*
Imitative aggression	9.69	<.05	<.05	<.025	<.001	*ns*	*ns*	*ns*

From Bandura, Ross and Ross: Vicarious reinforcement and imitative learning.

of pairs of scores by the Mann-Whitney *U* test, show that children who observed the model amass rewards through aggression displayed significantly more imitative aggressive behavior than did children in the other three groups which did not differ from each other in this respect (Table 2).

Not only were the children more inclined to reproduce the behavior of the rewarded model, but they also preferred to emulate the aggressive model more frequently when he secured attractive rewards through physical aggression, than when he was punished for displaying the same behavior, or was simply permitted access to the rewarding resources and behaved in a prosocial manner (Table 3). A chi square analysis of these data provided a value of 19.85 which is significant beyond the .001 level. Although several of the expected theoretical frequencies were less than 5, the extremely high significance level adds to the reliability of these findings. . . .

TABLE 3

Percentage of Children in the Model Rewarded, Model Punished, and Nonaggressive Model Groups Selecting Rocky or Johnny as Objects of Imitation

CHOICE OF MODEL	AGGRESSIVE MODEL-REWARDED	AGGRESSIVE MODEL-PUNISHED	NONAGGRESSIVE MODEL
Rocky	60	20	0
Johnny	5	20	30
No preference	35	60	70

From Bandura, Ross and Ross: Vicarious reinforcement and imitative learning.

DISCUSSION

The results of the present study provide support for the hypothesis that imitation is partly dependent on response-consequences to the model. Children who witnessed the Aggressive Model-Rewarded showed more imitative aggression and preferred to emulate the successful aggressor than children in the Aggressive Model-Punished group who both failed to reproduce his behavior and rejected him as a model for emulation. . . .

REFERENCES

Bandura, A. Social learning through imitation. In M. R. Jones (Ed.), *Nebraska symposium on motivation: 1962*. Lincoln: Univer. Nebraska Press, 1962. Pp. 211–269.

Bandura, A., Ross, Dorothea, & Ross, Sheila A. Transmission of aggression through imitation of aggressive models. *J. abnorm. soc. Psychol.*, 1961, **63,** 575–582.

Bandura, A., Ross, Dorothea, & Ross, Sheila A. Imitation of film-mediated aggressive models. *J. abnorm. soc. Psychol.*, 1963, **66,** 3–11.

Bandura, A., & Walters, R. H. *Social learning and personality development.* New York: Holt, Rinehart and Winston, 1963.

Barnett, P. E., & Benedetti, D. T. A study in "vicarious conditioning." Paper read at Rocky Mountain Psychological Association, Glenwood Springs, Colorado, May 1960.

Berger, S. M. Conditioning through vicarious instigation. *Psychol. Rev.*, 1962, **69,** 450–466.

Crawford, M. P., & Spence, K. W. Observational learning of discrimination problems by chimpanzees. *J. comp. Psychol.*, 1939, **27,** 133–147.

Haner, C. F., & Whitney, E. R. Emphatic conditioning and its relation to anxiety level. *Amer. Psychologist*, 1960, **15,** 493. (Abstract)

Hill, W. F. Learning theory and the acquisition of values. *Psychol. Rev.*, 1960, **67,** 317–331.

Logan, F., Olmsted, O. L., Rosner, B. S., Schwartz, R. D., & Stevens, C. M. *Behavior theory and social science.* New Haven: Yale Univer. Press, 1955.

Lövaas, O. J. Effect of exposure to symbolic aggression on aggressive behavior. *Child Develpm.*, 1961, **32,** 37–44.

McBrearty, J. F., Marston, A. R., & Kanfer, F. H. Conditioning a verbal operant in a group setting: Direct vs. vicarious reinforcement. *Amer. Psychologist*, 1961, **16,** 425. (Abstract)

Maccoby, Eleanor E. Role-taking in childhood and its consequences for social learning. *Child Develpm.*, 1959, **30,** 239–252.

Mowrer, O. H. *Learning theory and the symbolic processes.* New York: Wiley, 1960.

Mussen, P. H., & Rutherford, E. Effects of aggressive cartoons on children's aggressive play. *J. abnorm. soc. Psychol.*, 1961, **62,** 461–464.

Walters, R. H., Leat, Marion, & Mezei, L. Response inhibition and disinhibition through empathetic learning. *Canad. J. Psychol.*, 1963, in press.

Walters, R. H., Llewellyn-Thomas, E., & Acker, C. W. Enhancement of punitive behavior by audio-visual displays. *Science*, 1962, **136,** 872–873.

7.

Deprivation and Satiation of Social Reinforcers as Drive Conditions*

Jacob L. Gewirtz[1] *and Donald M. Baer*[2]

In an earlier study (6) we received what appeared to be an affirmative answer to the question: Are there social drives that respond to reinforcer deprivation as do the primary appetitive drives? In this investigation we extend the question, asking in addition if the behaviors maintained by social reinforcers are responsive also to a condition of relative satiation for such reinforcers. Children are again employed as subjects (Ss).

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* From J. L. Gewirtz and D. J. Baer, Deprivation and satiation of social reinforcers as drive conditions, *J. abnorm. Soc. Psychol.*, **57,** 165–172 (1958). Reprinted by permission of the authors and the American Psychological Association.

[1] This study was carried out when the senior author was on the faculty of the University of Chicago, and was facilitated by a grant given to him by the Social Science Research Committee of that institution. The writers acknowledge with gratitude the discriminating assistance of Chaya H. Roth.

[2] At the time of this study, the junior author was a Public Health Service Predoctoral Research Fellow of the National Institute of Mental Health at the University of Chicago.

In the earlier study it was found that when an adult made words and phrases like "Good!" and "Mm-hmm" contingent upon an arbitrarily chosen response in nursery school children, that response was reinforced (i.e., conditioned). This effect was similar to that found in several other studies using verbal stimuli appealing to the concept of *approval* as reinforcers (e.g., 2, 9, 12, 16). It was found, in addition, that this reinforcing effect of approval could be increased when the children experienced a preceding 20-minute period of social isolation, relative to its effectiveness for the same children when they had not been isolated. While this result held primarily for boys tested by a female (rather than male) experimenter, other aspects of the data clearly supported the equating of isolation to the deprivation of social reinforcers: *social isolation increased reliably the reinforcing power of adult approval for children as a positive function of the degree to which they typically sought such approval in other settings.* Approval was taken to be representative of the reinforcers which control the purely social initiations made by children to adults.

Deprivation implies a period of unavailability of a given reinforcer, which results in an increase in behaviors for it; *satiation* implies a period of availability of a reinforcer, sufficient to effect a decrease in behaviors for it. Thus, deprivation and satiation represent two statements of a single concept, a dimension characterized by the relative supply of a reinforcer in the recent history of an organism which determines the incidence of behaviors for that reinforcer. The concept of deprivation-satiation has considerable precedent as a drive operation in general behavior theory (e.g., 11, 14), where it has been employed to order contemporary conditions which account for variance in reinforcer effectiveness. As such, drive is generally defined as the functional relation between deprivation (or satiation) for a reinforcer and responding for that reinforcer. Further, concepts like deprivation have been somewhat loosely applied in a number of speculative formulations of the antecedents of certain social behaviors (e.g., 1, 8, 13, 15). Hence, laws relating social deprivation as an empirically defined dimension to certain basic characteristics of social behaviors would have considerable integrative value (5). But first, the experimental operations of deprivation and its inverse, satiation, must be implemented effectively in social terms.

In the earlier study cited (6), a beginning attempt was made to implement social deprivation: brief social isolation of a child was equated to a condition of deprivation of all social reinforcers (including approval), and the differential effects of that condition and of a comparison nonisolation (nondeprivation) condition were reflected in the reinforcing effectiveness of an adult's approval. The present study represents an attempt to simplify (and replicate) the social deprivation operation of the earlier study, as well as a beginning in the direction of establishing an operation of social satiation. Satiation will be equated to a condition in which an abundance of approval and social contact is supplied to a child by an adult. Experimental operations implementing the conditions of deprivation and of satiation for a class of social reinforcers are both reflected against an intermediate or nondeprivation (nonsatiated) condition. The hypothesis is that these conditions should enhance the effectiveness of the reinforcer in the order: Deprivation > Nondeprivation > Satiation.

Method

SAMPLE

The Ss were 102 middle-class children selected from the classes of the first and second grades of a university laboratory school and randomly assigned to experimental conditions. Sixteen were Negro, the remainder white. Their mean age at the time of testing was seven years, six months, with a range from six and one-half to nine years. Their mean and median Stanford-Binet IQ score was 127 (the scores of only 3 Ss were below 100). One-half of the Ss under each condition were girls and one-half boys. The Ss were selected by their teachers according to the order in which their names appeared on alphabetical class lists. No S refused to participate.

INDEPENDENT VARIABLE

Deprivation

Seventeen boys and 17 girls were subjected to a condition of social isolation before playing the game. Each of these Ss was introduced to the experimenter (*E*) in the classroom by the teacher. The *E* was a young woman in her early twenties.[3] She walked with S a distance of several hundred feet through the school corridors to the experimental room. During this walk, *E* responded to S's questions and comments only when necessary, and maintained a somewhat distant but not unfriendly manner at all times. Upon reaching the experimental room, *E* showed S around the room, seated him and told him that someone else was using the game which he was to play and that she would have to fetch it but would be back in a little while. *E* then left the room and went (unobserved) to an adjacent observation booth from which S was observed during his isolation. She returned after 20 minutes with the toy. The game was then played in the usual fashion. The Ss, who occasionally accompanied adults in the school setting for tests, and who had experience in awaiting their turns, all accepted this condition without question.

Nondeprivation

Seventeen boys and 17 girls were subjected to a condition of nonisolation, i.e., they played the game immediately upon their arrival at the experimental room. (Since this condition represents both relative nondeprivation and relative nonsatiation for approval, it served as an intermediate control condition for the other two conditions.) Until they entered the experimental room, Ss in this group were treated identically as were Ss in the Deprivation group.

Satiation

Seventeen boys and 17 girls were subjected to a condition of relative satiation for approval from the adult before playing the game. Again, each of these Ss was introduced to *E* in the classroom by the teacher, but during the walk to the experimental room, *E* maintained a very pleasant and interested attitude toward *S*, responding to all details of his comments and questions, asking questions to draw out more of *S*'s conversation, and generally approving of anything about *S* which might reasonably be praised or admired. Upon reaching the experimental room, *E* showed *S* around the room, seated him, told him that the game was in use elsewhere and that she would go fetch it in a little while when it would be free. She suggested that meanwhile S might like to draw pictures or cut out designs, and proffered the essential materials. Then, for 20 minutes S drew or cut out designs, while *E* maintained a stream of friendly conversation with him, inducing him to talk about himself if he did not do so naturally. The *E* alternated her praise and admiration of whatever *S* did with whatever he said about himself, all in an appropriate fashion, and attempted to dispense 30 such reinforcers during the 20-minute satiation period at an approximate rate of three every two minutes. In fact, *E* dispensed to the boys an average of 31.6 such reinforcers ($\sigma = 6.9$) and to the girls an average of 28.2 reinforcers ($\sigma = 8.1$).

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[3] This *E* served as one of the two *Es* in a companion study (6).

THE GAME SETTING

Following the experimental treatment, the central task for *S* (which was the same for all three groups) was to place marbles into either of the two holes of the toy (shown in Fig. 1) while *E*, who sat beside him, looked on. (This procedure was identical to that employed in the earlier study (6) and is only summarized here.) The *E* observed *S*'s play for a "baseline" period of four minutes, during which *no* reinforcers were dispensed. Meanwhile, *E* responded to any of *S*'s comments and questions in a friendly but brief manner. Without pause, the baseline period was followed by a 10-minute test of reinforcer effectiveness. That is, *E* proceeded at this point to dispense the reinforcer, consisting of words like "Good," "Hm-hmm," and "Fine," according to a schedule incorporating several, successively higher, fixed ratios, whenever *S* dropped marbles into the *correct* hole, defined as that preferred *least* during the last (fourth) minute of the baseline period.

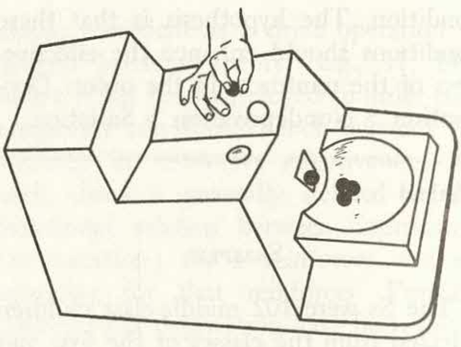

FIG. 1. A schematic diagram of the experimental apparatus (the "game"). From Gewirtz and Baer: Deprivation and satiation of social reinforcers as drive conditions.

DEPENDENT VARIABLES

Reinforcer effectiveness score

The determination of the effectiveness of approval as a reinforcer was made from the "game" which followed immediately the treatment condition (i.e., the 20 minutes of Deprivation or of Satiation, or in the Nondeprivation condition, the arrival at the experimental room). The basic data were the numbers of marbles dropped in the correct and incorrect holes during each minute of play. These generated four pairs of frequency scores for the baseline period, and 10 such pairs of scores for the reinforcer effectiveness test period. For each minute of play, the *relative frequency* of a correct response was the ratio of correct responses to total responses, i.e., # correct/(# correct + # incorrect). The score employed as dependent variable was taken as the difference, for each *S*, between the relative frequency of correct responses in the last (fourth) minute of the baseline period (when no reinforcers were dispensed) and the median relative frequency of correct responses of the 10 reinforcer test period minutes. This *reinforcer effectiveness score* represents the *gain* in relative frequency of the correct response attributable to the social reinforcer provided by the adult's approval.

Spontaneous social initiations

In addition, the verbal and purely social initiations of the child to the adult were tallied, but *only during the baseline period of the game*, before she began to dispense approval. The *E* treated the game as *S*'s central task and, while permissive, generally discouraged lengthy initiations on the part of *S*, suggesting, when necessary, that they could converse at length after the game. Where a reply to an initiation of *S* was required, *E*'s response was always friendly, yet brief, leaving responsibility for continuing that interaction sequence in *S*'s hands. All such responses by *S* were tallied by an observer in an observation booth. These responses took the form most frequently of Comments, less frequently of Questions, and least frequently of overt Attention-seeking.[4] They could be expected to represent behaviors by *S* for a variety of social reinforcers, in addition to approval. *Comments* were casual remarks which usually required no formal response from *E* (e.g., "We're going away for the holiday"). *Questions*, which were also casual, required only brief, token replies from *E* (e.g., "Do you think it will rain?"). When making a comment or asking a question, *S* typically continued responding in the game. *Attention-seeking* included responses characterized by urgency designed for active notice from *E*. Typically, *S* would pause to direct his complete attention to *E* while awaiting a response (e.g., "Watch me put the marble into this hole!"). Because of their generally infrequent occurrence in this study, these three behavior categories are scored in two different ways to produce two relatively independent response indices for the purpose of analysis:

a. The sum of the frequencies in the three social response categories, Comments, Questions, and Attention-seeking, which weights those categories in proportion to their frequency of occurrence (i.e., Comments contributes most and Attention-seeking least to that index).

b. The score of a *cumulative Guttman-like scale* (10), indexing what appears to be the intensity of social contact, formed similarly as in (3) when the frequency scores for each verbal response category were dichotomized for each *S* into gross response alternatives, zero or nonzero frequency of occurrence.[5] A scale score of 3 indicated that an *S* had exhibited some of all three behaviors; a score of 2 indicated that some Comments and Questions were exhibited, but no Attention-seeking; a score of 1 indicated that only Comments were exhibited; and a score of zero indicated that no social response of any type was exhibited. Hence, the scale scores are weighted in favor of the less frequently occurring behavior categories, Questions and Attention-seeking.

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[4] These three observation categories are defined in detail in (3). High agreement between observers was found there on these behavior categories, and they entered into similar patterns of relationship with the independent variables. Moreover, they were found in (4) to have high loadings on a single factor and appeared to involve an active attempt to gain or to maintain the adult's attention, perhaps differing in the degree to which their initiations for attention were overt or direct.

Results

The hypothesis advanced is that the mean reinforcer effectiveness scores for the treatment groups would rank in the order Deprivation > Nondeprivation > Satiation. To test this, two relatively independent statistical procedures are followed: the first is sensitive to the rank-order of the treatment means but does not take account of the degree of overlap between the distributions upon which the means are based; and the second, which takes such information into account and allows parametric statements about the means, is somewhat less sensitive to the rank-order hypothesis.

REINFORCER EFFECTIVENESS SCORE

Rank-order of the means

In Table 1, it is seen that the rank-order predicted for the three means is found separately for Boys and for Girls. The sex variable may be taken as an independent replication of the experiment. The theoretical probability of obtaining a predicted rank-order of three independent means is $1/6$, and with one independent replication the probability of obtaining two such orders is $1/6 \times 1/6$ or $1/36$. On this basis, we can conclude that the null hypothesis, that all six rank-orders of the three means are equally likely, is rejected at $p < .03$. Hence, the alternative hypothesis, that the predicted rank-order of the three means prevails, is accepted.

Regression analysis

For the purposes of the regression analysis (and for theoretical reasons as well), the three treatment conditions are considered as points along a single continuous dimension representing the degree of social deprivation. The analysis then proceeds from three working assumptions: (*a*) the units separating the treatments along this deprivation dimension are roughly equal in size, (*b*) their relationship to the reinforcer effectiveness

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[5] Of all 102 Ss in the four-minute baseline period, the proportion showing nonzero category frequencies was .71 for Comments, .53 for Questions, and .15 for Attention-seeking. When the response categories were arranged in the order of their decreasing popularities (the proportion of *S*s exhibiting nonzero frequencies), it was concluded that, for present purposes, a satisfactory three-item Guttman-like scale was produced: only .03 of the 306 responses produced scale errors, the few scale errors found appeared random, and every observation category contained far less error than nonerror. Of the 68 *S*s in the Deprivation and Nondeprivation groups, five each produced one scale error in his response pattern. Such response patterns were assigned scale scores corresponding to the higher pattern which would have been attained had there been no scale error.

TABLE 1

Table of Means

SEX	DEPRIVATION (D)	SATIATION (S)	½ (D + S)	NON-DEPRIVATION
Boys	.36*	.18*	.27**	.21*
Girls	.33*	.07*	.20**	.23*
Combined	.34**	.13**	.23***	.22**

* 17 cases; S.E. of a mean difference is .068.
** 34 cases; S.E. of a mean difference is .048.
*** 68 cases.

From Gewirtz and Baer: Deprivation and satiation of social reinforcers as drive conditions.

means is linear, and (c) it is the *pattern* of the three means that is relevant to the rank-order hypothesis advanced, not the contrasts between mean pairs representing adjacent points on the postulated treatment dimension. On this basis, it appears most efficient to carry out the analysis of variance according to a regression model: in essence, to analyze the regression of the reinforcer effectiveness score means on the treatment dimension.

The reinforcer effectiveness scores of the Ss were classified in the six cells of a 3 × 2 factorial, there being three treatments and two sexes of Ss. After a Bartlett test indicated that the variances were homogeneous and an examination of the data suggested that the other assumptions underlying the analysis appeared to hold, the data were subjected to an analysis of variance. Table 2 indicates that there is no over-all sex difference, and that the treatment conditions do not affect the sex groups differentially. From Fig. 2, it is seen that the group means corresponding to the three levels of the experimental variable rank-order according to the hypothesis. It is seen in Table 2 that the Deprivation vs. Satiation comparison is reliable and in the order predicted. In the case of three means, this comparison represents the regression of those means on the treatment dimension. A Nondeprivation vs. ½ (Deprivation + Satiation) comparison, which represents the deviation of the Nondeprivation mean from the regression line, indicates that that mean falls remarkably close to the regression line. Hence, the regression predicted was found. (This result provides presumptive evidence only for the effectiveness of either of the extreme treatments, Deprivation or Satiation, relative to the intermediate Nondeprivation treatment.)

Approval as a reinforcer

A question of interest is whether the reinforcer dispensed was effective as such under Nondeprivation, which would be comparable to the usual experimental case under which the effectiveness of the reinforcer would be examined, as well as following Satiation, when the reinforcer was relatively least effective in this experiment. The hypothesis is tested that the mean reinforcer effectiveness score under Nondeprivation is zero, employing an error term based only upon those 34 scores and

TABLE 2

Summary of the Analysis of Variance of the Reinforcer Effectiveness Score

SOURCE OF VARIATION	*df*	MEAN SQUARE	*F*
Boys vs. Girls (Sex)	1	.0412	.524
Treatments			
total	(2)	(.4032)	(5.123*)
deprivation (D) vs. satiation (S)[a]	1	.8031	10.200**
nondeprivation (N) vs. ½ (D + S)[b]	1	.0034	.043
Sex × Treatment interaction			
total	(2)	(.0356)	(.452)
sex × D vs. S	1	.0268	.341
sex × N vs. ½ (D + S)	1	.0444	.564
Error (within groups)	96	.0787	

[a] Due to regression.

[b] Due to the deviation of the *N* mean from the regression line.

* $p < .01$.

** $p < .005$.

From Gewirtz and Baer: Deprivation and satiation of social reinforcers as drive conditions.

a one-tail *t* test. That mean score (.22) is found to be reliably greater than zero at $p < .0005$. A similar test indicates that the Satiation condition of this study did not reduce the reinforcing effectiveness of approval to a zero level; the mean reinforcer effectiveness score following Satiation (.13) was reliably greater than zero at $p < .01$. Hence, it may be concluded that approval was effective as a reinforcer under all conditions, and that satiation was not complete but only relative.

SPONTANEOUS SOCIAL INITIATIONS

An examination of *Ss'* spontaneous verbal initiations to *E* during *only* the four-minute baseline period of the game can reinforce the conclusions drawn from the reinforcer effectiveness score (which reflects only the susceptibility of *Ss* to approval as a reinforcer). These initiations could be expected to represent behaviors

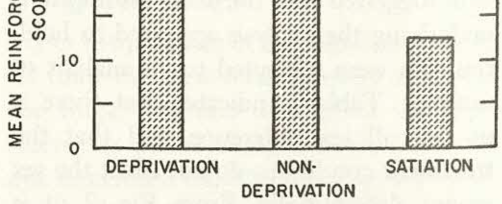

FIG. 2. A pictorial representation of the means for the three levels of the experimental variable (34 *Ss* per condition). From Gewirtz and Baer: Deprivation and satiation of social reinforcers as drive conditions.

by *S* for a variety of social reinforcers from *E* and, hence, might be sensitive as well to the treatments. It should be noted that *E* did not dispense approval during the baseline period, but merely looked on as *S* put marbles into the toy. (Because the Satiation treatment consisted of a period of intensive social contact between *E* and *S*, which could encourage *S* to continue to make social initiations during the game, only a comparison of the verbal social response scores between the Deprivation and Nondeprivation groups would be meaningful.)

The *total frequency of verbal initiation* scores was classified in a 2×2 factorial (Deprivation vs. Nondeprivation and Boys vs. Girls) and subjected to an analysis of variance. The mean number of verbal responses (Comments, Questions, and Attention-seeking) after Deprivation (4.4) was found to be reliably greater than that after Nondeprivation (2.3) at $p < .05$ ($F = 3.70$, 1 and 64 *df*, one-tail test). At the same time, the Treatment × Sex interaction effect was not reliable, indicating that the two treatments did not affect the sexes differentially.

The scale scores represent what appears to be the *intensity of social contact*, or the degree to which certain social reinforcers apart from approval (e.g., attention) are sought from the adult, and could take any one of the four values from zero to three. They were classified in a fourfold table, with *low* scores of zero and one taken to represent less intense social contact, and *high* scores of two and three taken to represent more intense social contact. It was found that 20 out of the 34 Ss exhibited high scale scores after Deprivation, while only 12 of the 34 Ss exhibited such high scale scores after Nondeprivation, indicating at $p < .05$ (chi square corrected for discontinuity $= 2.89$, 1 *df*, one-tail test) that a greater proportion of Ss exhibited more intense social contact scores after Deprivation than after Nondeprivation.

Hence, the two relatively independent indices derived from the three categories of spontaneous verbal initiations to *E* *both* reinforce the conclusions derived from the measure of the reinforcing effectiveness of *E*'s approval.

DISCUSSION

In the earlier study cited (as in this study), the experimental operation of brief social isolation of the child was equated to a condition of deprivation[6] of all social reinforcers (including approval). Hence, it became important to demonstrate that this condition increases the incidence of behaviors for approval relative to an empirically defined level of satiation for that reinforcer. The results suggest that this has been accomplished. And since under the Nondeprivation condition Ss had just come from class, with no further experimental treatment, it seemed reasonable that it would represent some point intermediate between the other conditions. The rank-order of the mean reinforcer effectiveness scores for these three conditions followed this logic precisely and was uncomplicated by an interaction involving sex of Ss. Hence, the results replicate the finding of the earlier study concerning the greater effectiveness of approval after Deprivation, relative to Nondeprivation. While the mean difference between reinforcer effectiveness scores for Deprivation and Nondeprivation for the Ss in this study (ranging in age from 6-6 to 9-0) appears to be of the same order as that for the *S*s in the earlier study (who ranged in age from 3–10 to 5–3), the absolute level of the means appears to be higher.

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[6] An analysis of some possible Deprivation condition artifacts is made in (6).

The two indices drawn from the three spontaneous verbal social initiation categories reinforced the conclusions based on the index of the reinforcing effectiveness of *E*'s approval for the Deprivation and Nondeprivation conditions (where a difference test was meaningful). It seems likely then, if the game-set were dispensed with and the natural or spontaneous social initiations to *E* were employed as the sole dependent variable, that similar conclusions would be drawn from the results. However, if the present establishing operation for satiation were to be employed in such a study, it would still be almost impossible to separate the social effects of satiation from the artifactual effects of *S*s' greater familiarity with *E*.

The essence of the parallel between our use of the term drive for social reinforcers and the traditional use of the term for the deprivation of food and water reinforcers, as in hunger and thirst, lies in the definition of a drive as the functional relation between deprivation for a reinforcer and responding for that reinforcer. In that special sense, then, it would appear that there exist for children social drives that respond to social reinforcer deprivation similarly as do many primary appetitive drives. Yet it should not be supposed that the results of this study validate decisively the conclusion that a social reinforcer follows a deprivation-satiation logic. The responsiveness of a reinforcer to relative values of both deprivation and satiation represents only one requirement under this logic. Social reinforcers may be supplied and deprived in a variety of ways, and it is important to discover their responsiveness to many of these ways. It would be especially important, for example, to implement the deprivation of a *single* social reinforcer, rather than of all social reinforcers. Further, it is essential to have some assurance that the social reinforcers are more or less homogeneous in this regard, for verbal approval may not be representative of the reinforcers controlling the purely social initiations made by children to adults. Replications of these effects with other social reinforcers (e.g., attention) would strengthen the conclusions, as would parametric studies of the deprivation-satiation dimension. Another assumption is that approval had acquired reinforcing value for children through a history of conditioning. A stronger case would result if approval were demonstrated to be a more effective reinforcer than, say, a comparable nonsocial noise produced by a machine; or if that noise were shown to be less affected than approval by deprivation-satiation conditions like those employed here. Even so, the earlier finding (6) that isolation enhanced the reinforcing power of adult approval for *S*s as a positive function of the degree to which they sought adult approval in other settings would indicate against both these possibilities. And the difference in spontaneous social initiations following Deprivation and Nondeprivation supports the more general conclusions drawn here; those behaviors were very likely employed for social reinforcers other than approval.

While the results of this study can stand in their own right, several additional experimental conditions could help elucidate the processes at issue. Thus, it would be useful to separate the effects of some of the three components of the satiation condition employed, namely, (*a*) *E*'s physical presence, (*b*) the social interaction between *E* and *S*, and (*c*) the approval reinforcers dispensed by *E* to *S*. To do this, it would be necessary to employ such conditions as, for example, one in which *E* sits with *S* for 20 minutes but says nothing, or one in which approval is dispensed without *E*, possibly out of "thin air." While some such conditions might be difficult to implement, the attempt to establish conditions like these would be worth while in the context of this experiment. Even so, the results of an experiment (3) on related behavior (for attention) suggest that a condition in which *E* sits near *S* but interacts minimally with him (only upon request) functions more as a condition of social deprivation than as one of satiation (7).

Apart from these considerations, the standard primary-conditioned reinforcer issue in the study of animal drives cannot be involved as such in this case. We have assumed that some sort of conditioned reinforcer is at issue, but haven't separated out conclusively the effects of the several stimulus components of that conditioned reinforcer. At the very worst, then, it isn't clear that the social reinforcer dispensed is independent of *E*. We have already noted the possibility that noise, rather than social noise, might constitute the reinforcing stimulus. Apart from this, however, it does not seem significant to consider social reinforcers as separate from the person dispensing them: they are eminently social noises in our logic; and their social character refers not only to their presumed history but also to the method of their delivery.

Additional considerations

In the earlier study, two *Es* were employed to dispense the social reinforcer, one male and one female. An interaction effect was found which indicated, among other things, that the increase in the effectiveness of approval as a reinforcer, brought on by Deprivation relative to Nondeprivation, was greatest for boys with the female *E*. This change was not reliable for the other three Sex of *S* × Sex of *E* groups. In this experiment, in which both boys and girls were tested by a female *E*, no Treatment × Sex interaction was found (although the Satiation mean of girls may not have differed from zero). Hence, to that extent, the previous results are not replicated, but the conclusions can be drawn more generally. (This finding could be referred to the postulate that *Ss* of this study are "latent" [in the Freudian sense], while those in the earlier study were "Oedipal." However, there exist other possibilities, including slight changes in method, to explain the discordant results of the two studies on this issue.)

Only one reinforcer-dispensing *E* was employed, and she was not unaware of the expected direction of the results. Her behavior was scored by objective and easily discriminated criteria and judged satisfactory. Still, there remains some reason for caution; for the findings of this experiment cannot be conclusive until they are widely replicated with similar and improved procedures. Nevertheless, the reliability of the results is supported by the difference between the Deprivation and Nondeprivation groups on the spontaneous social initiations made to *E* before she began to dispense the reinforcer: there, where it was even less likely that *E* could influence the outcome, the finding paralleled precisely that derived from the reinforcer effectiveness index.

SUMMARY

On the assumption that approval is representative of the reinforcers control-

ling the purely social initiations of children to adults, the verbal approval of a female *E* was made contingent upon one response in a two-response game for 102 first- and second-grade children (*Ss*) of a university laboratory school. The change in relative response frequency from a baseline level following introduction of the reinforcer indicated the degree to which approval was reinforcing for an *S*.

Before playing the game, *Ss* were subjected to one of three experimental conditions: 34 *Ss* were subjected to a 20-minute period of isolation (conceived to be social *Deprivation*); 34 *Ss* played the game immediately upon coming from class (conceived to be an intermediate condition between deprivation and satiation, and called *Nondeprivation*); and 34 *Ss* devoted 20 minutes to drawing and cutting out designs, while *E* maintained a stream of friendly conversation with each of them and approved and admired their art efforts and statements in an appropriate fashion (conceived to be *Satiation* for approval and social contact). There were 17 boys and 17 girls in each experimental group.

Employing two independent tests (one on the order of the means, the other on the regression of the means on the treatment dimension), it was found that the rank-order hypothesis advanced was reliably supported (at $p < .03$ and $p < .005$ respectively). The reinforcing effectiveness of approval was relatively greatest after Deprivation, intermediate after Nondeprivation, and least after Satiation. Approval functioned as a reinforcer after all conditions, even Satiation ($p < .01$). Boys and girls were affected similarly on this measure by the experimental conditions.

The spontaneous social initiations made by *Ss* to *E*, before she had begun to dispense approval in the game, supported the results based on the index of the effectiveness of approval as a reinforcer. Following the Deprivation condition, there resulted a greater mean frequency of social initiations ($p < .05$), and a larger proportion of *Ss* exhibiting apparently intense social interaction ($p < .05$), than there did following the Nondeprivation condition. (The nature of the establishing operation for the Satiation condition precluded a meaningful comparison of the other conditions with it on these social behaviors.)

Thus, a reinforcer appearing to be typical of those involved in children's social drives appears responsive to deprivation and satiation operations of a similar order as those controlling the effectiveness of reinforcers of a number of the primary appetitive drives.

REFERENCES

1. Bowlby, J. Maternal care and mental health. *Bull. World Hlth. Org. Monogr.*, 1951, **3,** 355–533.
2. Chase, Lucille. Motivation of young children: An experimental study of the influences of certain types of external incentives upon the performance of a task. *Univer. Iowa Stud. Child Welf.*, 1932, **5,** No. 3. Pp. 119.
3. Gewirtz, J. L. Three determinants of attention-seeking in young children. *Monogr. Soc. Res. Child. Develpm.*, 1954, **19,** No. 2 (Serial No. 59).
4. Gewirtz, J. L. A factor analysis of some attention-seeking behaviors of young children. *Child Develpm.*, 1956, **27,** 17–36.
5. Gewirtz, J. L. A program of research on the dimensions and antecedents of emotional dependence. *Child Develpm.*, 1956, **27,** 205–221.
6. Gewirtz, J. L., & Baer, D. M. The effect of brief social deprivation on behav-

iors for a social reinforcer. *J. abnorm. soc. Psychol.*, 1958, **56,** 49–56.

7. Gewirtz, J. L., Baer, D. M., & Roth, Chaya H. A note on the similar effects of low social availability of an adult and brief social deprivation on young children's behavior. *Child Develpm.*, 1958, **29,** 149–152.
8. Goldfarb, W. Psychological privation in infancy and subsequent adjustment. *Amer. J. Orthopsychiat.*, 1945, **15,** 247–255.
9. Greenspoon, J. The reinforcing effects of two spoken words on the frequency of two responses. *Amer. J. Psychol.*, 1955, **68,** 409–416.
10. Guttman, L. The basis of scalogram analysis. In S. A. Stouffer *et al. Measurement and prediction*. Princeton, N.J.: Princeton Univer. Press, 1950. Pp. 60–90.
11. Hull, C. L. *A behavior system*. New Haven: Yale Univer. Press, 1952.
12. Hurlock, Elizabeth B. The value of praise and reproof as incentives for children. *Arch. Psychol., N.Y.*, 1924, **11,** No. 71, 5–78.
13. Ribble, Margaret. Infantile experience in relation to personality development. In J. McV. Hunt (Ed.), *Personality and the behavior disorders*. New York: Ronald, 1944. Pp. 621–651.
14. Skinner, B. F. *Science and human behavior*. New York: Macmillan, 1953.
15. Spitz, R. A. Hospitalism: An inquiry into the genesis of psychiatric conditions in early childhood. In Anna Freud *et al.* (Eds.), *The psychoanalytic study of the child*. Vol. 1. New York: Int. Universities Press, 1945. Pp. 53–74.
16. Wolf, Theta H. The effect of praise and competition on the persistent behavior of kindergarten children. *Univer. Minn. Child Welf. Monogr. Series*, 1938, No. 15. Pp. 138.

chapter III

Verbal Behavior

IT HAS BEEN STATED many times that above everything else it is language behavior which most distinguishes man from lower animals. Furthermore, language appears to be fundamental to most other behaviors of man in which we are interested. The greatest achievements as well as commonplace adjustments, intellectual as well as social-emotional behaviors, and scientific as well as artistic activities depend upon language. Moreover, the acquisition of new skills, intellectual and motor, depends heavily upon language. And few social interactions occur that do not depend upon or involve language. Thus, we must be interested in both the manner in which language is acquired as a learned behavior repertoire as well as in how that repertoire *functions* in the individual's adjustment and further learning. In recent years there has been a sharp acceleration in experimental and theoretical activity concerning the learning of language and also the function of language. The present chapter, the following one, and later articles will deal with language as it is important to such human activities as communication, thinking and reasoning, purposive planning, attitude development and change, motivation, social interaction, and mathematics learning.

The present section is concerned with the way in which some of the principles of operant conditioning have been extended to the consideration of verbal behavior. This field of study originally received its greatest impetus from B. F. Skinner in his book *Verbal Behavior* (1957). Prior to the accumulation of experimental evidence based upon a strict operant conditioning methodology, Skinner outlined a number of forms of language behavior which are apparently acquired according to reinforcement principles. Some of the outcomes of that analysis are presented herein.

The article analyzing a comparison in the development in speech and reading is presented first because it summarizes some of the relevant operant conditioning principles and indicates how they may be involved in the acquisition of certain important aspects of language. Although the article is concerned especially with reading, it presents a general analysis which is a foundation for subsequent studies in other sections as well as the present one. A more detailed analysis of reading acquisition which follows from this article will be presented later in this section.

Following Skinner's analysis of verbal behavior in terms of operant conditioning principles, a number of experimental studies were conducted in which the single principle of reinforcement was extended to this realm of behavior. This was done by applying some reinforcing stimulus contingent upon a class of verbal behaviors. The frequency of occurrence of members of the class of verbal responses was tabulated in these studies to see if the expected strengthening effect of reinforcement took place. In general the effect has been observed—when members of a class of word responses are reinforced, the members of the class are emitted in greater frequency. Although this type of result requires a more detailed analysis (which will be given in the next chapter), the studies do indicate that response contingent reinforcement can shape verbal behavior. The next two studies, in addition to the specific contributions they make, also show clearly the effect of reinforcement upon verbal behavior.

In the next study by Rheingold, Gewirtz, and Ross, the fact that reinforcement principles begin to effect verbal behavior at even very early ages is shown. Vocal responses in three-month-old infants are strengthening through response contingent social reinforcement. This study appears to have many implications. First, by its success, it suggests that experimental methods may be devised for research on this central type of behavior even when the behavior is still very primitive. In addition, the study has implications for practical considerations and suggests further study. That is, if reinforcement in a short experimental procedure can shape the infant's language development, might not a systematic study of various aspects tell us a good deal about maximal conditions for producing good language development. The last article in this chapter will deal with these implications in greater detail.

The article by Salzinger, Salzinger, Portnoy, Eckman, Bacon, Deutsch, and Zubin gives additional support to the suggestion that reinforcement variables continue to shape verbal behavior in children. Continuous speech in 6–7-year-old children was increased through reinforcement. Reinforcement schedules were also found to effect resistance to extinction of the conditioned rate of speech.

In addition, to providing the theoretical analysis which gave impetus to the experimental study of language in terms of operant conditioning principles and methods, B. F. Skinner and his associates have also extended a similar analysis to some of the problems of education. Much educational training involves the development of verbal repertoires of behavior which are under appropriate stimulus control, according to this view. As a consequence, the reasoning might go, an analysis of the behavior involved in terms of its units, could lead to a better method of shaping the final repertoire. In addition, some of the technology which has been developed to achieve experimental control in the laboratory may be adapted to educational procedures so that the presentation of the stimulus materials could be maximal in effect and not subject to uncontrolled vagaries. Furthermore, immediately presented, response-contingent reinforcement should help solve the problems involved in maintaining "studying behavior." The next two articles deal with the extensions of reinforcement principles and methods, especially those involved in the analysis of verbal behavior, to some applications to educational problems.

The first article by Holland is presented to show the relationship of the programed instruction movement to laboratory established principles and methods, and to summarize some of the concepts of programed instruction. Next, Gilbert, in this excerpt from a longer article, discusses first some basic behavioral principles, reinforcement and response chaining. Then he applies these concepts to the analysis of the act of long division and to a method for programing this type of learning. Gilbert's article also has general significance in showing the importance of the "theoretical" analysis of a task in behavioral terms prior to commencing research or programing—a point which is made explicit later.

Applications of programed instruction techniques have now been applied to a wide number of different subject matters. However, the movement should not be seen only as a specific technology of programing various academic subject matters. The most general implication of the movement is that experimental methods and learning principles are applicable to the study of various problems of human behavior—not just to circumscribed problems of traditional classroom education. The next article indicates some of the possibilities for extensions beyond the original definition of the field of programed instruction.

This article summarizes a long-term research project which attempts an analysis of the original acquisition of reading, following the approach laid down in the first article in this chapter. In addition, an outline is given of a general strategy for the further extension of learning principles and methods to the study of various complex human behaviors. This strategy and the problems discussed are relevant also to the final chapter of this book which is concerned with the treatment of problems of behavior. It is suggested here that the empirical principles of behavior have been validated within the context of complex human behavior and the treatment of behavior problems. However, the task of completing experimental and theoretical analyses of complex human behavior problems in learning terms as well as the task of developing (learning) programs for the treatment of these problems lies largely ahead.

8.

A Comparison of the Development of Speech and Reading Behavior with Implications for Research*[1]

Arthur W. Staats and
Carolyn K. Staats

Recent experimental and theoretical work in experimental psychology provides a framework for understanding some of the special problems which exist in the development of language. The purpose of the present paper is to extend a number of the established behavioral principles to the area of language development and to emphasize some of the special problems involved in the acquisition of reading skills.

The principles to be developed are those of operant conditioning or operant learning and the primary sources are Keller and Schoenfeld (7) and Skinner (12). In this respect, the present approach is like that of Gewirtz (3), who discussed emotional dependence in this JOURNAL. The language activities of children are considered herein to be behaviors which are subject to these principles of acquisition. A full presentation of language development must include the principles of classical conditioning and the interaction of classical and operant principles in the development of word meaning (13, 14, 15, 17). However, these principles will not be dealt with at this time.

Specifically, this paper will describe the principles by which speech responses in general, and speech responses to particular aspects of environmental stimuli, are developed into precise language behaviors. It will be pointed out that in certain respects the teaching of verbal responses to visually presented verbal stimuli (reading) deviates from the acquisition of speech in ways which make the acquisition of reading much more difficult. Consideration of the principles involved and the differences in the two types of learning should yield a better understanding of the problems involved in learning to read and thus suggest productive lines of research.

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* From A. W. Staats and C. K. Staats, A comparison of the development of speech and reading behavior with implications for research, *Child Developm.*, **33,** 831–846 (1962). Reprinted by permission of the authors and The Society for Research in Child Development, Inc.

[1] The analysis was made by the first author in a longer version as the basic rationale for a research project on reading, and prepared for journal publication with the help of the second author. The project was sponsored by the Office of Education, Cooperative Research Branch, under Contract No. 1048 and by the Office of Naval Research under Contract Nonr-2794(02).

Principles

OPERANT LEARNING

A simple and very general law of behavior is that a response followed by certain "consequences," which in everyday life are called rewards, will in the future occur more frequently. That is, the response will be strengthened. The objective term for such a consequence is *positive reinforcer* or *reinforcing stimulus*. On the other hand, a response whose "consequence" is the removal of an aversive state of affairs is also strengthened. A stimulus whose removal has this effect is called a *negative reinforcer*. Stimuli whose removal is reinforcing are called "unpleasant" or "punishing" in everyday life.

REINFORCING STIMULI

Reinforcing stimuli may differ for different species and for different individuals within a species. Some stimuli have this reinforcing effect soon after birth without any evidence of training being required. To a baby deprived of milk, milk as a stimulus object will strengthen any operant behavior it follows. Food, water, warmth, and other such stimuli are unlearned, or primary positive reinforcers. Conversely, since the removal of wet and chaffing diapers will strengthen the response of crying, this event constitutes a primary negative reinforcer.

There are many other stimuli which originally are not reinforcing, i.e., are neutral with respect to their effect upon the strength of behavior, but which become "secondary" reinforcers by being present when a reinforcing stimulus occurs. A neutral stimulus paired with the presentation of a positive reinforcer will become a positive reinforcer itself; a neutral stimulus paired with the presentation of a negative reinforcer will become a negative reinforcer.

In addition, responses may themselves become secondary reinforcers. This can occur because every response of an organism produces stimuli which, if frequently associated with reinforcement, may become reinforcing stimuli themselves.

TIME AND SCHEDULING OF REINFORCEMENT

Although detail is not possible here, some additional principles should be stressed. First, the *time* intervening between the response and the reinforcer is very important. The shorter the interval, the more the response is strengthened for future occasions. If the interval is too long, learning does not occur. Secondly, the *schedule* of presenting reinforcement is also crucial. For example, after a response has been reinforced many times, it is possible to maintain the response at some strength by reinforcing it only a portion of the times it is emitted. The ratio of nonreinforcement to reinforcement trials may be slowly increased until the response is maintained in strength by very infrequent reinforcement.

SUCCESSIVE APPROXIMATION

Many responses occur so infrequently that it would be highly impractical to wait for their occurrence so that they could be reinforced. However, operant learning can take place in a gradual manner. A response which ordinarily would not occur in finished form can be "shaped" by first rewarding gross approximations to the final response and then gradually reinforcing only the better approximations to the desired response. This type of shaping is possible because a particular response is actually a member of a class of similar responses. Each response has many variations and involves, prior to refined operant training, other closely related responses. Thus, reinforcing a response actually strengthens a class of responses which will include variants which are closer approximations to the final response desired. When the more desirable variants are selectively reinforced, a new class of responses will be strengthened which will include new variants even closer to the desired response, and these may then be reinforced. The process of differentiating out the desired variants in each class in a series of steps is called *successive approximation*.

CHAINING

Every response produces characteristic stimuli, thus responses themselves may become "joined" into chains or series of responses through conditioning. One response, through the stimuli it produces, will come to control the next response, and so on. This is the principle of *chaining*. Most sequences of skilled movements are of this type, as are chains of associated word responses in adult language.

EXTINCTION

Another important principle is that of *extinction*. A response which has been strengthened by reinforcement will weaken if it is no longer followed by reinforcement. Thus, to weaken a response to its prereinforcement strength, reinforcement should be withheld whenever that response occurs.

DISCRIMINATION AND GENERALIZATION

For human adjustment it is important, not only that a response be made, but also that it be made in the appropriate circumstances or stimulus situation. The principle of *stimulus discrimination* describes how a stimulus comes to control a particular response. When a response is reinforced in the presence of a certain stimulus and is not reinforced in the absence of the stimulus, that response will come to occur only in the presence of the stimulus. When the stimulus occurs the response occurs; when the stimulus is withdrawn the response does not occur, or does so only infrequently.

In addition, when a particular stimulus has come to control a response, similar stimuli will, to the extent of their similarity, also control this same response. This is called the principle of *stimulus generalization*.

Extension of These Principles to Certain Aspects of Language Behavior

While these principles in their simple form will not account for all of language behavior, some significant applications of the principles may be made within the scope of this paper. The discussion will deal first with certain aspects of the development of the child's early language behavior and then with some of the special problems in the acquisition of reading behavior.

SPEECH LEARNING

During the first month of life, for the most part, a baby's vocal sounds do not resemble speech. Vocalizations involve crying, a few squeaks, clucks, and so on. During the first several months, however, the infant produces varied sounds which have duplicates in human speech.

The extent to which the first behavioral development of this kind as due to maturational factors versus the effects of reinforcement history need not concern us here. It is important to note, however, that a study by Rheingold, Gewirtz, and Ross (11) has shown that this type of behavior can be operantly conditioned even at an early age, under the action of an adult's social response as the reinforcer. In this very simply conducted study 12 3-month-old infants were used as subjects. First, a preconditioning baseline tabulation was made for each infant. During this period the experimenter was in view of the infant, but maintained an expressionless face. During the conditioning phase the experimenter reinforced each vocal response by smiling, clucking, and lightly squeezing the infant's abdomen. In the third phase of the study, extinction, the experimenter again did not reinforce the speech responses. The authors found (a) that the mean vocalizing rate was higher during conditioning than during baseline or extinction and (b) the mean rate was higher during the second than during the first conditioning day. The importance of these results can be seen more clearly when it is realized that this primitive speech behavior is the basic class of behaviors from which more and more precise speech responses may be differentiated.

Sources of Reinforcement

Before discussing further the development of speech, the types of reinforcers which are effective in shaping early vocal behavior should be noted. One type of reinforcement is that which is delivered by the parents at the time of the response. This could involve primary reinforcers such as food, relief from pain, etc., or, as in the Rheingold, Gewirtz, and Ross study, secondary reinforcers such as the smiles of the parents and the sounds they make.

Another important source of reinforcement involved in the child's language development consists of the sounds which the child himself produces. Mowrer (9) and Miller and Dollard (8) have described the manner in which the sounds the child produces become secondary reinforcers and shape early language development.

> Since the mother talks to the child while administering primary rewards such as food, the sound of the human voice should acquire secondary reward value. Because the child's voice produces sounds similar to that of his mother's, some of this acquired reward value generalizes to it. . . . From this hypothesis it may be deduced that children talked to while being fed and otherwise cared for should exhibit more iterative and imitative babbling than children not talked to while being rewarded (8, p. 277).

In the terms developed in the present discussion, the sounds of the mother's voice become secondary positive reinforcers because these sound stimuli have been paired with other positive reinforcers. On this basis it would be expected that a response on the part of the child which produced a sound that was in some way similar to sounds produced by the parents would be strengthened and would occur more frequently.

Further Developments in Early Speech

On the basis of recordings made of a child's vocalizations during the first year of life, Osgood has concluded that infants make "all the speech sounds that the human vocal system can produce, including French vowels and trills, German umlaut and guttural sounds, and many that are only describable in phonetic symbols. This is in flat contradiction to the notion that the infant gradually 'becomes capable' of making various sounds" (10, p. 684). Evidently the structures and muscular flexibility are present by which the infant can produce many different sounds—many more than he will eventually make habitually.

Although the infant may initially make all types of speech sounds, in time the frequency of making certain sounds undergoes a change. Thus, a child's vocal behavior becomes increasingly more like that of the vocal behavior of the adults in the child's environment (5, 6). This progression would be expected on the basis of certain sounds of the parents becoming positive conditioned reinforcers. As an example, the language environment of a child raised in an English-speaking home would consist of syllable sounds like *ba, ma, da, kee, lo, foo,* etc. Since these sounds occur frequently in the speech of the parents, and in the presence of positive reinforcers given by the parents, they become positive reinforcers. Vocal responses by the child which produced similar sounds would thus be immediately reinforced and the responses would increase in frequency. Responses which produced sounds which were not reinforcing in this way would extinguish, or not increase in strength.

On the basis of this principle, and after a series of such differentiations from the infant's extended class of speech response, the child's speech repertoire includes responses more and more like the syllables which occur in the adult speech of his language community. This type of verbal behavior is often called babbling. Many of the sounds now produced by the vocal responses will approximate word and phrase responses emitted by the parents. It is interesting to note, as would be expected on the basis of this analysis, that deaf children do not progress into the babbling stage of vocal development in the same manner as children with normal hearing. Since the deaf child is not sensitive to the speech sounds, they cannot become secondary reinforcers and strengthen his own vocal responses.

From the babbling stage to the development of the first few speech responses which are appropriately emitted involves continued differentiation of the class of babbling responses. However, when the child finally utters its first clearly recognizable words in the proximity of the parents, there is customarily immediate and strong reinforcement, and the child's verbal response class enters a new phase of more rapid shaping. At this point the parents' direct and immediate reinforcement of speech responses probably assumes an important role in the shaping of the child's speech, although the self-reinforcement provided by saying words like those of the parents will continue to be effective. The parents now become more sensitive to the speech responses of the child and reinforce even close approximations to English words. Speech responses like "wahwah" may be reinforced with a drink of water, and "da" may be reinforced by the presentation of the child's toy dog. In this manner a rudimentary repertoire of speech responses is further differentiated out of the large class of vocal responses which the child formerly made.

CONTINUED SHAPING OF SPEECH THROUGH SUCCESSIVE APPROXIMATION

However, "wahwah, wahda, wuhda, wata, watah," and so on, are not examples of the precise speech sound of "water" which is made in the English speech community. Further successive approximation from several sources of reinforcement acts to shape gradually the speech responses of the child to more and more precise duplicates of adult speech.

There are several sources of this differential reinforcement. First, adults or other children less familiar than the parents with the child's speech may not respond at all to the child's grosser verbal responses, thus reinforcing only the better pronunciations. In this way, the better responses of the child will be subjected to greater reinforcement and the poorer ones extinguished. Or better responses may be more quickly reinforced. For example, when the child emits a verbal response and is asked, "What did you say?" reinforcement is postponed, a further response is required, and this verbal response receives less strengthening than one to which the listener immediately makes an appropriate response. Thus, the differential reinforcement of better speech responses by parents and by others, especially in terms of the time of reinforcement, is responsible for the gradual shaping of better speech behaviors in the child.

FORMULATION OF VERBAL DISCRIMINATIONS

Progress in speech development also involves discrimination training which results in a type of speech behavior that Skinner calls *echoic behavior*. What is meant by this term is that the child learns to echo, or repeat, what the parent says, upon request to do so.

> An echoic repertoire is established in the child through "educational" reinforcement because it is useful to parents, teachers, and others. It makes possible short-circuiting of the process of progressive approximation, since it can be used to evoke new units of response upon which other types of reinforcement may then be made contingent. The educational reinforcement is usually supplied with the aid of . . . Say 'X,' where the listener, becoming a speaker, is reinforced if his response yields the sound pattern 'X' (12, p. 56).

It is important to point out that syllabic units come under "echoic" control so that entirely new words may be quickly produced by the child when he "echoes" the syllables pronounced by the adult training him. The learning task which remains in this case only involves establishing a chain between the syllable responses the child already has in his repertoire.

SPEECH DISCRIMINATION TO ENVIRONMENTAL STIMULI

In order to present clearly the different principles involved, the process of shaping correct speech was separated from the processes involved in the emission of the speech at the proper time and place; that is, the process whereby speech comes under the control of the appropriate environmental stimuli. In actuality, the child is involved in both types of learning simultaneously. He is trained to make "good" speech responses at the same time he is trained to make them only in certain circumstances. The principle involved is the discrimination of a speech response (12).

When the child first says "daddy" or an approximation, the child's parents usually reinforce this response, whether or not the father is present, and whether or not the child is looking at the father. This experience strengthens the response, but in the presence of many different stimuli. Thus, the response does not occur in any specific situation. Once this speech response has been strengthened to the point where it occurs frequently, however, even to inappropriate stimuli, the discrimination training customarily starts. Only when the child says "daddy" in the presence of the father does reinforcement occur. The response is consequently extinguished in the presence of other adults and children.

At this point the response might not be precisely under the control of the appropriate stimulus. Although the child no longer says "daddy" in the presence of mother and does in the presence of the father, it might be found that he also says "daddy" in the presence of stimulus objects similar to father, for example, other males. A salesman calling in the afternoon, when father usually comes home, may be greeted by the child's response, "daddy." This is of course an illustration of the simple principle of stimulus generalization. However, since the child will not be reinforced for this generalized response, in due time his speech response will come under the precise control of the stimulus object, father. Skinner calls such a discriminated speech response a *tact*.

> A tact may be defined as a verbal operant in which a response of given form is evoked (or at least strengthened) by a particular object or event or property of an object or event. We account for the strength by showing that in the presence of the object or event a response of that form is characteristically reinforced in a given verbal community (12, pp. 81–82).

After the child has acquired the basic sounds involved in English speech and is able, within limits, to produce sounds which match (i.e., echo) those produced by someone else, rapid speech vocabulary growth is possible. The mother can then simply present a new object and say its name, e.g., hold up a ball and say "ball." Reinforcement of the child's matching response while looking at the ball will establish the tact.

Numerous experiences of this type occur. When the child goes for an automobile ride with his parents, for a walk to the store, and so on, there are occasions when the child looks at an object or event at the same time as the appropriate word is presented. The child is asked to repeat the word, and the response is then reinforced. The child learns in this manner to tact environmental events as well as objects. For example, in the presence of a moving automobile the child is told that it is moving. When the child says "moving" in the presence of something moving, he is reinforced. A moving object will thus become the discriminative stimulus for that speech response. If an automobile is also a discriminative stimulus for the response "automobile," then in the presence of a moving automobile the child will tend to emit the response, "automobile moving," or some such statement. The child will thus learn simple and complex speech responses to environmental events, both simple and complicated.

The learning of tacts is also carried on in great detail in ordinary language training. Although the child may first be reinforced for saying "automobile" in the presence of the total stimulus object, he will eventually be reinforced for emitting the appropriate speech responses to various parts of the object. Thus, detailed discrimination training involving particular aspects of the total stimulus situation is ordinarily conducted as is shown in the number of environmental events which control particular speech behaviors.

In addition to this type of discriminated verbal behavior, a child will ordinarily receive training in responding to internal stimuli such as aches and pains, to stimuli produced by his own behavior, and to other types of stimuli. Thus, many complex, detailed, and subtle stimulus events eventually come to control the appropriate complex speech responses.

The Acquisition of Reading Behavior

TEXTING

It is important that speech responses be brought under the control of appropriate external and internal stimuli. In addition, it is equally important that speech responses come under the control of appropriate visually presented verbal stimuli. In Skinner's terminology (12) this is called *texting*. A textual response is a speech response that is under the control of the appropriate visually presented verbal stimulus. In everyday terms this is simply called reading.

Textual behavior is formed in a manner similar to that involved in learning a repertoire of speech responses to the other types of stimuli. Ordinarily, however, by the time training in textual behavior commences, the child has acquired the necessary speech responses. Thus, the child is able to match his speech responses to those given by the person guiding the instruction. A simple model for training a textual response is to present the written verbal stimulus to the child, say the word aloud, and have the child make a response which approximates the sound. For example, the word *dog* could be presented to the pupil, or group of pupils, and the teacher says "dog." The pupil responds by saying "dog" while looking at the word stimulus. Later, the stimulus word is again presented the pupil who will tend to say "dog" with no prompting. When the visually presented stimulus word will elicit the appropriate speech response, the child is said to be able to read the word.

The verbal discriminations which must take place in the acquisition of reading are also very fine and detailed. For example, it will be found that a child who has come to respond to the stimulus *the* with the response "the" will also respond at first in the same manner to *then,* and perhaps to *there,* and so on. Since the stimuli are quite similar, stimulus generalization occurs. The same is true of such words as *pat, sat, hat, fat,* and so forth. Thus, a great deal of training is necessary to produce the correct discriminations.

Textual responses may be acquired in finer units than whole words either through the repeated experiences of the child in reading or through formal training. The units of which stimulus words are composed will come to control unitary speech responses of which word responses are composed. Accordingly, the child will come to emit the correct speech response in the presence of the syllabic units and single letters of which the words are composed. For example, when the stimuli *p, s, h,* and *f* have come to control the speech unit responses which produce the "p," "s," "h," and "f" sounds, respectively, and, if the stimulus *at* controls the speech response producing the "at" sound, then the discrimination between the verbal stimuli *pat, sat, hat,* and *fat* is complete.

When this type of discriminative control of textual behavior has been conditioned, the acquisition of speech responses under the control of novel stimulus words may take place. That is, the pupil becomes capable of learning a new textual response by responding successively to the letters and syllables of the stimulus word. The syllables will be "linked" so that the first elicits the second, and so on, in a manner which had not occurred before. The new word response would be under the control of the appropriate visual stimulus. Of course, if the word response was not one which the child had previously received training for emitting in appropriate circumstances, the simple establishment of the speech response controlled by a visual word stimulus would not affect its other language functions. The word response would not be under the control of other stimuli and would not, consequently, occur in appropriate circumstances, nor would such a word be meaningful.[2]

A Comparison between Speech Development and Reading Acquisition

Interesting comparisons may be made between the learning of verbal responses to nonverbal stimuli and the learning of those same responses to visual verbal stimuli, that is, learning to read. It was said earlier that the same principles are involved in both types of learning. Both are essentially problems of establishing verbal responses under stimulus control. If that is the case, why then is reading behavior so much more difficult to acquire? Virtually every intact individual acquires adequate speech behaviors, yet there are many individuals who, although they display adequate vocal behaviors, are seemingly unable to learn to read, or do so only with great difficulty.

It is commonly suggested that such uneven development is a result of some biological defect, such as neurological impairment. However, unless there is some independent observation of a defect, this type of conclusion may simply be *ad hoc*. If the child is capable of acquiring differential speech responses to the ordinary visual stimuli in a normal manner, then it should be possible for visual verbal stimuli also to come to control the verbal responses. There is certainly no obvious difference in the stimuli themselves, since both are visual and both are complex. Ordinary language behavior requires that verbal responses be under the control of very subtle aspects of one's stimulus environment. The same thing is true of reading, i.e., the stimuli are no more complex.

On the other hand, on the basis of the present analysis, it would seem that, exclusive of personal defect, there are some very real reasons why some people do not learn to read even though their speech development is otherwise normal. Actually, for everyone, learning to read is accomplished only with great difficulty in comparison to the acquisition of speech under the control of other stimuli. To indicate the reasons, several important characteristics of the acquisition of speech responses and the process whereby speech responses come under the control of external and internal stimuli should be emphasized.

First, as has been implicit in the previous discussion, the process of speech acquisition is very gradual. Beginning with the strengthening of the general speech class in early infancy, more and more precise speech responses are gradually shaped up until the exact word responses of the language community occur. These responses are only gradually brought under the control of the appropriate stimulus objects in a long program of training. Learning sessions occur intermittently and are dispersed throughout the day. In addition, new objects are introduced over a period of years in building up verbal discriminations.

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[2] These aspects of language learning are not considered herein, but have been dealt with in other works (13, 14, 15, 17).

Secondly, there are strong sources of reinforcement involved. When the child first says "wahtar," the strong reinforcer of a cup of water is presented. When the child says "baybee," the strong reinforcer of a baby doll is presented. In addition, strong reinforcers are abundantly available in the attention and approval of people in the environment. When the child says "look" and another child responds by looking, this is a reinforcer for the verbal response.

Thirdly, these strong reinforcers are individually applied, and they are applied immediately following the speech behaviors involved. As has been discussed, it is most important that the reinforcing stimulus be presented quickly after a response has occurred. If no reinforcer is presented, or if the lag is too great, the response will not be strengthened.

INTENSITY OF TRAINING IN READING

Comparing these characteristics with those involved in the acquisition of reading behavior, it becomes obvious that the learning of reading would be more difficult for everyone. Unlike speech behavior itself, and speech behavior under the control of other types of stimuli, reading is not gradually acquired in the preschool years. It is customary to introduce training in the acquisition of speech responses to visually presented verbal stimuli only when the child enters school. Although there is some attempt to make this more gradual through the use of nursery schools, kindergartens, and reading readiness programs, in comparison to the learning of speech responses, the onset of reading training is sudden and intensive.

This major difference between speech and reading learning has important consequences. For example, intensive periods involving the acquisition, or the performance, of responses may be considered to have aversive characteristics. It has been shown that discriminative stimuli acquire aversive characteristics after an extended period of "working" in the presence of the stimuli, even when the responses involved are reinforced. That is, another response which will remove the discriminative stimulus will be maintained in some strength. Furthermore, the more intensive the "work" is (i.e., the greater the ratio of responses to reinforcement), the more aversive the discriminative stimulus becomes (1).

Naturalistic observations also suggest that the intensive rather than gradual training of reading has aversive aspects. Many children describe school and school activities as "work," and in aversive terms. Although the language learning which takes place prior to school training is just as complex, and in these terms just as difficult to acquire, it is not described as being trying or difficult to the same extent as is formal training. The child does not say that he is having, or has had, a difficult time in learning to speak—or learning his extensive repertoire of discriminated verbal operants.

In addition, to the extent that the school situation is aversive, it will be reinforcing to "escape" the situation. Any behavior which removes the child from the aversive situation will be strengthened. Thus, behaviors such as talking to other pupils, cutting up, doodling and playing quiet games, teasing other pupils, daydreaming, etc., will be strengthened by providing an escape from the aversive training situation. Of course, it is possible to make the behavior of leaving the situation in these ways more aversive through punishment and, in this manner, maintain good participation in learning. Education in former times utilized these methods.

It would seem, then, that there might be two ways to deal with the problems introduced by such an intensive training program. First, it should be possible to reduce the aversive nature of the onset of formal training by having it introduced considerably more gradually. In addition, the introduction of positive reinforcers into such an intensive program would change the situation in the direction of making it more positively reinforcing. To some extent, both of these developments have occurred in American education. Nursery schools, kindergartens, and reading readiness programs do make the training somewhat more gradual. In addition, an attempt has been made to make learning more gamelike, lifelike, or "interesting" (i.e., reinforcing) and less worklike (i.e., aversive). These methods have sometimes been identified by the term "progressive" education. Unfortunately, it is well established that the acquisition of reading still forms a problem of training; the corrective measures taken thus far have not been adequate.

Sources of Reinforcement for Reading in the School Situation

A closer look at some of the sources of reinforcement available in the early school situation will indicate some of the remaining difficulties. To an extent dependent upon the child's past history, the acquisition of a new behavior (i.e., learning) may become reinforcing itself. That is, the stimuli produced by studying something and acquiring new "knowledge" (verbal behaviors) or "skills" (motor behaviors) will become secondary reinforcers if positive reinforcers have been frequently paired with them in the past. It is traditionally assumed that this type of reinforcement should be present for all students, witness the old saw, "Learning is (or should be) its own reward." Again, however, this cannot be counted upon. Many children do not have a past history which has made learning itself reinforcing. When this is the case, it is ineffective simply to invoke the plea that learning *should* be reinforcing.

The same thing occurs in making educators and their approval secondary reinforcers. For some children the teacher's attention and approval are strong reinforcing stimuli. Since these are learned reinforcers, the extent to which they function as reinforcers will depend upon the past history of the child. If the child comes from a home which has not paired learning with reinforcing stimuli, where education and educators have not become secondary reinforcers, he would be said to have little "value" for education. The teacher's approval would have scant reinforcing properties in such a case. Unfortunately, many children would be expected to have ineffective histories in this respect.

In addition to the inadequacy of the teacher's approval as a positive reinforcer for some children, there are other restrictions upon the effectiveness of this source of reinforcement. In the school situation, reading training involves a group of children. To a large extent, this makes impossible the presentation of the reinforcement immediately contingent upon the behavior of the individual child. Only when the child recites individually may his behavior be immediately reinforced by other persons, and, of course, only a small proportion of school time will be occupied with the behavior of any one child. Much of the work takes place in group study or group recital where no extrinsic reinforcement is involved.

There are other reinforcers in the school program such as grades, special privileges, games, recesses, and the approval of other students. In kindergarten the children are provided with toys, snacks, rest periods, television, and so on. These stimuli undoubtedly act as reinforcers for some children. However, these reinforcers are seldom presented contingent upon correct reading behavior, and even when contingent they are not immediately delivered. In addition, most of the available reinforcing stimuli are heavyweight reinforcers which are delivered all at one time, whereas the behavior involved consists of numerous responses, a good proportion of which should be individually reinforced.

The reinforcers available in the school situation may vary from child to child. And, for some children there may be only weak reinforcers which are made contingent upon his reading behavior. In addition, there is a "snowballing" effect, since the child for whom there are only weak reinforcers in the school situation learns to read very slowly. Because he accomplishes little, he receives less reinforcement contingent upon his classroom performance, and his behavior becomes relatively weaker. It may be concluded that, as compared to speech learning in everyday life, learning to read occurs in a situation much less favorable in terms of the application of reinforcement principles. It would thus be expected that many failures would occur in the development of this vital repertoire of behaviors.

One final point. If positive reinforcers available in the school situation are weak or ineffectively applied, then the behaviors which are prerequisites to the acquisition of reading will not be maintained. To acquire reading behavior, the child must first respond by looking at the words and letters and then by making the appropriate verbal responses to the prompts of the teacher. If these prerequisite behaviors, which in everyday terms are called the attention of the child, are extinguished through lack of sufficient reinforcement, then further progress in learning to read ceases. Such a child would not acquire proper reading behavior even though present in class during appropriate training. It would certainly be erroneous to conclude in such a case that the child had some physical defect.

A summary of the important points involved in this section might be as follows. First, the onset of an intensive training program in reading is relatively sudden and may involve a good deal of aversiveness. In addition, there are only weak sources of reinforcement for many children in the training situation. Furthermore, the reinforcers which are available are not made immediately contingent upon the many "reading responses" involved. Finally, if adequate reinforcement for the child is not available in the reading program, the behaviors which are prerequisites for the acquisition of reading may extinguish. If this happens, progress in learning to read will cease.

Implications for Research

It becomes evident from this comparison that there are important implications for understanding some of the special problems encountered in learning to read and for conducting research on reading acquisition. Although it is not within the scope of this paper to outline a research program based upon the present analysis, a few examples can be given to indicate the type of research which might be derived.

The rationale which suggests applications to a study of reading can be stated in the following points:

1. If the prerequisite behaviors of attending to and working at the acquisition of speech responses to visual verbal stimuli are not reinforced they will extinguish.
2. The more intensive the training, the more aversive such training becomes.
3. This aversiveness will act as a strong negative reinforcer, and incompatible behaviors which remove the child from the aversive situation (absenteeism, cutting up, daydreaming, etc.) will increase in frequency.
4. The use of positive reinforcers, immediately contingent upon the prerequisite behaviors involved in the acquisition of reading, could prevent the extinction of these behaviors and prevent or reverse the learning of incompatible behaviors.
5. Reinforcement of reading would also make this behavior itself become positively reinforcing.
6. As a consequence of the use of reinforcement for reading, very rapid learning should occur.

These points strongly suggest that reading learning should be studied in a procedure involving the immediate application of positive reinforcers for attending to and working at the acquisition of textual responses. Experimenters are already studying the possibilities of shaping simple behaviors in children through the use of various reinforcers (2). Trinkets, tokens, money of small value, toys, music, snacks, approval, and so forth, have been used in various combinations. The results indicate that the principles discussed herein are applicable to the training of children and therefore they should be applicable to the significant area of reading.[3]

From such study the basic principles involved in learning to read could be determined, and the information obtained would be important for application to the establishment of future training programs. Such research would be a direct outgrowth of this type of analysis concerning the application of behavior principles to the area of reading development.

Further study must be made of the possible use of existing sources of reinforcement. The snacks, toys, recesses, etc., usual in the kindergarten are strong reinforcers, but they are not made specifically contingent upon the behavior which is to be developed. This might be possible, however, through the use of a token system where the token was made contingent upon the behavior to be strengthened. The tokens could be established as secondary reinforcers by being paired with the reinforcers already available in the situation.

It may be said that there are practical restrictions involved in the use of individually applied reinforcers in a teaching situation. Teacher time in a more individualized program might be excessive. In addition, some people might oppose the use of extrinsic reinforcers in the training of children. However, *a priori* judgments such as these are not justified. Before practical circumstances can be adequately evaluated, it is necessary to understand the principles of behavior which are involved in language learning and to have empirical results upon which to make decisions.

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[3] Results of the Reading Research project described in the first footnote, which will be reported in detail at a later time, indicate that reading behaviors are rapidly acquired where reinforcers such as these are used and that the learning situation is responded to more favorably by the pupils, i.e., exceptional work habits and attention are obtained from even very young children (4 years old). The individual subjects who have been studied (16) produce operant conditioning curves which are sensitive to the presentation and withdrawal of the extrinsic reinforcers, as would be expected on the basis of operant conditioning principles.

Actually, these types of objections may prove to be unwarranted once a program of the type described has been developed for reading training. For example, it might be possible to mechanize the training program, including the delivery of reinforcers. Recent successes with automated teaching devices, even without the use of extrinsic reinforcers, indicate this as a likely possibility (4).

In addition, with the rapid learning which the use of reinforcement would promote, perhaps only a short program would need to be involved until the appropriate reading units are acquired. That is, perhaps an intensive program of reinforcement is necessary only until units of verbal responses (e.g., syllable and letter responses) come under the control of appropriate visual stimuli. Once this has occurred, the child will be able to read many different words the first time they are presented and less supervision would be necessary for further progress. Thus, it might be more effective to spend time with the individual child in the early phases of reading training than to prolong less effective training which proceeds slowly and produces many failures. Only research of the suggested type will provide this information.

Along this line, it should be pointed out that learning the initial behaviors involved in reading has intrinsic value only if the child has been trained in such a manner that learning is reinforcing. Otherwise, acquiring reading responses involves a great deal of effort or "work," i.e., it is not reinforcing. Once the unit speech responses have been well acquired, however, the same amount of work is not involved. Then reading has the same reinforcing value as being told a story. At this point it would not be necessary to continue the frequent extrinsic reinforcement of reading behaviors. (A more detailed analysis of this rationale is available, but is not presented at this time.)

It is also possible that a one-to-one ratio of student to teacher using a program including extrinsic reinforcers would be appropriate for working with special populations of children, e.g., retarded children, deaf or blind children, remedial readers, etc. Learning here could be strongly accelerated and make the one-to-one relationship practical, especially since the type of program which may emerge would not require highly trained individuals as administrators. It would be expected that the program would be especially pertinent for retarded children, since much of their learning problem probably involves the weak and slow learning of secondary reinforcers.

These are all issues which can only be resolved by conducting appropriate research. An understanding of the behavior principles involved in language learning indicates what some of the lines of research should be. Through this type of analysis and research it is hoped that the findings of general psychology and the practical problems of child development and education can be brought into a useful relationship.

REFERENCES

1. Azrin, N. H. Time-out from positive reinforcement. *Science*, 1961, **133,** 382–383.
2. Bijou, S. W., & Sturges, P. T. Positive reinforcers for experimental studies with children–consumables and manipulatables. *Child Develpm.*, 1959, **30,** 151–170.
3. Gewirtz, J. L. A program of research on the dimensions and antecedents of emotional dependence. *Child Develpm.*, 1956, **27,** 205–221.
4. Holland, J. G. Teaching machines: an application of principles from the laboratory. *J. exp. Anal. Behav.*, 1960, **3,** 275–287.
5. Irwin, O. C. Infant speech: development of vowel sounds. *J. Speech Hearing Disorders*, 1948, **13,** 31–34.
6. Irwin, O. C. Speech development in the young child: 2. Some factors related to the speech development of the infant and young child. *J. Speech Hearing Disorders*, 1952, **17,** 269–279.
7. Keller, F. S., & Schoenfeld, W. N. *Principles of psychology*. Appleton-Century-Crofts, 1950.
8. Miller, N. E., & Dollard, J. *Social learning and imitation*. Yale Univer. Press, 1941.
9. Mowrer, O. H. *Learning theory and personality dynamics*. Ronald Press, 1950.
10. Osgood, C. E. *Method and theory in experimental psychology*. Oxford Univer. Press, 1953.
11. Rheingold, H. L., Gewirtz, J. L., & Ross, H. W. Social conditioning of vocalizations in the infant. *J. comp. physiol. Psychol.*, 1959, **52,** 68–73.
12. Skinner, B. F. *Verbal behavior*. Appleton-Century-Crofts, 1957.
13. Staats, A. W. Verbal habit-families, concepts and the operant conditioning of word classes. *Psychol. Rev.*, 1961, **68,** 190–204.
14. Staats, A. W., & Staats, C. K. Meaning and *M:* correlated but separate. *Psychol. Rev.*, 1959, **66,** 136–144.
15. Staats, A. W., Staats, C. K., & Heard, W. G. Denotative meaning established by classical conditioning. *J. exp. Psychol.*, 1961, **61,** 300–303.
16. Staats, A. W., Staats, C. K., Schutz, R. E., & Wolfe, M. The conditioning of textual responses utilizing "extrinsic" reinforcers. *J. exp. Anal. Behav.*, 1962, **5,** 33–40.
17. Staats, C. K., & Staats, A. W. Meaning established by classical conditioning. *J. exp. Psychol.*, 1957, **54,** 74–80.

9.

Social Conditioning of Vocalizations in the Infant*

Harriet L. Rheingold, Jacob L. Gewirtz and Helen W. Ross

By three months of age the infant gives a well-defined social response to the appearance of adults. He looks at them intently, smiles, becomes active, and vocalizes. This behavior is repeated again and again in sequence. Adults often respond to these acts of the infant; they may only look at the child, but they may also smile to him, touch or caress him, or vocalize in return. Frequently one observes "answering" social and, in particular, vocal play between mother and child. The adults' responses may therefore play an important part in maintaining and developing social responsiveness in the child (Rheingold, 1956). The principles of operant conditioning (Skinner, 1953) suggest that some of these adult responses, functioning as reinforcers, may affect the development of the child's social behavior (Gewirtz, 1956). Thus, smiling in the infant has been shown to respond to conditioning (Brackbill, 1958).

The present study was an attempt to condition vocalizations in infants. Vocalizations were selected for study because they seem to provide an index of the whole social response (Rheingold, 1956). The reinforcing stimulus was a complex of social acts which resembled those an attentive adult might naturally make when a child vocalizes. If temporal contiguity between the infant's vocalization and the reinforcing stimulus, which follows it, brings about an increase in the vocalizations, conditioning may be said to have occurred. The possibility that the reinforcing stimulus may also have functioned as an arouser of vocalizations will be considered. In any case, the results of the study should provide further understanding about the development of social responsiveness, as well as of speech.

Method

Two parallel experiments were carried out in sequence. In the first, 11 babies (*Ss*) were studied, with one experimenter (*E*) and one observer-recorder (*O*), both women. In the second, 10 other Ss and one *S* from Experiment I were studied with the *E* and *O* of the first experiment exchanging roles. An experiment was composed of three successive units in each of which three or four *S*s were studied at one time.

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SUBJECTS

The *S*s were 21 infants, all residents almost from birth in the same institution. (We are grateful to Sister Thecla and the staff of St. Ann's Infant Asylum, Washington, D.C., for their generous cooperation.) Their median age was 3.0 months; three-quarters of them were no more than three days older or younger than the median. In each experiment six *S*s were male, five were female. Age was the main criterion for selection. Four possible *S*s were rejected: one seemed immature, two had a very high rate of vocalizing during the first baseline measure, and one was markedly fussy.

The institution offers excellent care and, as is characteristic of institutions, there are multiple caretakers. In general, the *S*s were well developed, healthy, alert, and socially responsive. The *E*s asked for no modifications in the usual caretaking routines. The caretakers knew that the *E*s were observing the development of social behavior, but they did not know the details of the experiment. The caretakers' usual behavior toward the *S*s appeared not to be modified by the conditions of the experiment.

EXPERIMENTAL CONDITIONS

Baseline

In experimental Days 1 and 2 (first and second Baseline days) *E* leaned over the crib with her face about 15 in. above *S*'s and looked at him with an expressionless face, while O tallied vocalizations, out of *S*'s sight. The *E* moved her head as necessary to remain in *S*'s line of vision, a condition which obtained throughout the experiments.

Conditioning

During experimental Days 3 and 4 (first and second Conditioning days), *E* again leaned over the crib with an expressionless face except that when *S* vocalized, *E* made an immediate response and then resumed the expressionless face until the next vocalization. The response, or *reinforcing stimulus*, consisted of three acts executed by *E* simultaneously, quickly, and smoothly. They were a broad smile, three "tsk" sounds, and a light touch applied to the infant's abdomen with thumb and fingers of the hand opposed. No more than a second of time was required to administer the reinforcer.

At the beginning of the conditioning periods each vocalization was reinforced. Sometimes, as the rate of vocalizing increased, only every second, and later, every third, vocalization was reinforced. In Experiment I, 72% of the reinforcers occurred after *each* vocalization; in Experiment II, 94%. Less frequent reinforcing seemed to depress the rate, at least initially, and, because of the rather severe time restrictions, was abandoned altogether by the end of the study.

Extinction

Experimental Days 5 and 6 (first and second Extinction days) were the same as Days 1 and 2; *E* leaned over the crib with an expressionless face and made no response to *S*'s vocalizations.

THE VOCAL RESPONSE

Every discrete, voiced sound produced by *S* was counted as a *vocalization*. A number of other sounds characteristically made by very young infants, e.g., straining sounds and coughs, and the whistles, squeaks, and snorts of noisy breathing, were not counted as vocalizations. Sounds falling under the categories of protests, fusses, and cries (see Emotional Behavior below) were recorded separately. No attempt was made to record the phonetic characteristics of any of the sounds or their duration.

Observer agreement

Agreement between two Os on the number of vocalizations produced by Ss in 3-min. periods was high. Counts for 27 periods, using 13 different Ss, yielded a median percentage agreement of 96 (range, 67 to 100). About half of these reliability measures were obtained at the Ss' cribs, and the rest from tape recordings made during the experiment. These two techniques yielded similar percentages of observer agreement.

The unit of measurement

The unit for statistical analysis was the number of vocalizations an S gave in a 3-min. period. The counts were recorded by half-minutes and these were summed to give the score for the 3-min. period. After a rest period of 2 min., in which both *E* and O walked away from the baby's crib, another 3-min. count was made. After a second rest period a third count was made.

In each day nine such 3-min. counts were planned, distributed thus: one block of three in the first part of the morning, the second block of three in the late morning, and the third block of three after the midday meal. The minimum amount of time between blocks was 10 min., although usually an hour or more elapsed.

Actually, nine periods of observations were obtained during only 80% of the 132 subject-days (22 Ss × 6 experimental days). Since three or four Ss were studied at a time, it was not always possible to find nine periods in a day when each was awake, alert, and content. Further, because the experiments were carried out in the nursery which the Ss shared with 12 other infants, the presence and activities of these other babies, and of the caretakers in carrying out their routines, sometimes made it impossible to obtain the desired number of periods.

EMOTIONAL BEHAVIOR

A number of responses which seemed to be "emotional" were recorded during the observation periods. These were: "protests," discrete sounds of a whining nature; "fusses," a series of sounds separated by a catch in the voice, whimpering; "cries" continuous loud, wailing sounds; "persistent looking away from *E*," rolling of the head from side to side or staring to one side or the other of *E*; and "marked hand activity," hand play, finger sucking, or face or head rubbing. The last two activities seemed to be attempts to avoid *E*. Measures of observer-agreement in the recording of these responses were not made.

Each of these responses was given a credit of one for each half-minute in which it occurred. From the sum for each S a mean score was obtained for each experimental day.

Results

SIMILARITY BETWEEN EXPERIMENTS

Figure 1 presents the means of both experiments for the six experimental days.

Each point represents the mean of 11 individual means. It was expected that the effect of the experimental conditions would be similar from experiment to experiment, but the extent to which the slopes of the curves would be congruent was not predicted.

The amount of similarity between the two experiments was estimated by an analysis of variance (Table 1), using Lindquist's Type VI design (1953). The analysis reveals no evidence of a difference between Experiments. Further, no source of variation involving Experiments is significant. (The difference between the two experiments in second Extinction day means is not significant; it suggests, however, that the less frequent reinforcement in Experiment I may have made the behavior more resistant to extinction.)

Three conclusions may be drawn from such close agreement in the results of two parallel experiments, each using different Ss and different *E*s: first, we are dealing with some relatively stable characteristics of three-month-old infants; second, the results may be accepted with confidence; and third, the results of the separate experiments may be pooled for all remaining analyses.

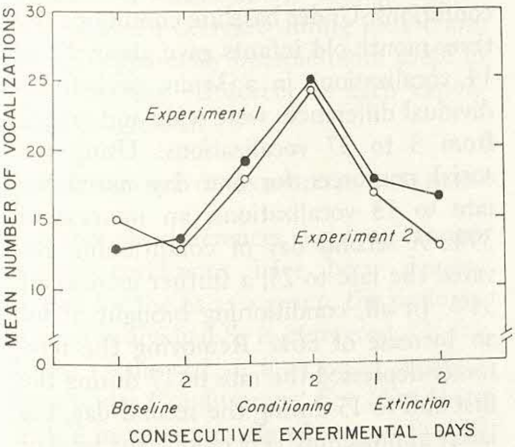

FIG. 1. Mean number of vocalizations on consecutive experimental days. From Rheingold, Gewirtz, and Ross: Social conditioning of vocalizations in the infant.

EFFECT OF EXPERIMENTAL CONDITIONS

Table 1 shows that there was a difference in the effect of the three two-day experimental conditions ($p < .001$), and, also, in the effect of successive days within conditions ($p < .001$). These effects were assessed by *t* tests (for paired data) on the amount of change from one day to another in the mean number of vocalizations given by individual Ss. The error term was derived only from the scores for the two days being compared. The tests on the pooled sample (21 *df*) show that:

1. There was no statistically significant difference in the mean number of vocalizations given in a 3-min. period from the first to the second Baseline day ($t = 0.87$, $p > .30$).

2. The mean number of vocalizations increased from the second Baseline day to the first Conditioning day ($t = 2.69$, $p < .01$).

3. A further increase occurred from the first to the second Conditioning day ($t = 3.61$, $p < .001$).

4. On the first Extinction day, vocalizations decreased ($t = 3.19$, $p < .0025$).

5. The mean number of vocalizations on the second Extinction day was smaller than on the first Extinction day, but the difference was not reliable ($t = 1.35$, $p < .10$).

6. There was no statistically significant difference between the mean number of vocalizations given on the second Extinction day and on the second Baseline day ($t = 1.20$, $p > .20$).

The tests between Baseline days and

TABLE 1

Analysis of Variance of Effect of Consecutive Experimental Days

SOURCE OF VARIATION	*df*	*MS*	*F*
Between Subjects	21		
experiments (1 vs. 2)	1	1218	0.03
error	20	45322	
Within Subjects	110		
conditions (Baseline vs. conditioning vs. extinction)	2	71243 (1)[a]	10.63*
days within conditions (1 vs. 2)	1	4205 (2)[a]	1.88
conditions × days	2	22917 (3)[a]	9.24*
days × experiments	1	1738 (2)[a]	0.78
conditions × experiments	2	2031 (1)[a]	0.30
conditions × days × experiments	2	866 (3)[a]	0.35
error 1	40	6703	
error 2	20	2233	
error 3	40	2481	

[a] Number in parentheses refers to the error term used. The terms were not pooled because of statistically significant differences among them.

* Significant at .001 level.

From Rheingold, Gewirtz and Ross: Social conditioning of vocalizations in the infant.

between Baseline and Extinction days were two-sided tests; the others were one-sided.

If final days within conditions are compared, the differences are more marked: the mean for the second Conditioning day is higher than that of the second Baseline day at $p < .0005$ ($t = 4.80$), and the second Extinction day mean is lower than the second Conditioning day mean at $p < .0005$ ($t = 4.08$). Similar differences occur between the means of experimental conditions, obtained by averaging the first- and second-day results for each condition.

Amount of Change in Number of Vocalizations

The treatment effects have been found reliable. It seems in order, therefore, to present the means of vocalizations for each day and to calculate the amount of change produced by the experimental conditions. Under baseline conditions the three-month-old infants gave about 13 to 14 vocalizations in a 3-min. period. Individual differences were wide and ranged from 3 to 37 vocalizations. Using the social reinforcer for one day raised the rate to 18 vocalizations, an increase of 39%. A second day of conditioning elevated the rate to 25, a further increase of 34%. In all, conditioning brought about an increase of 86%. Removing the reinforcer depressed the rate to 17 during the first and to 15 during the second day, the latter approaching very closely the level of baseline performance.

Emotional Behavior

Emotional behavior, while striking when it occurred, was observed infrequently. The largest mean for any day in both experiments was 3.0, the smallest was 1.9. The order of the means by experimental days was identical in the two experiments. It was: first Extinction day, second Extinction day, second Baseline day, second Conditioning day, first Conditioning day, and first Baseline day. The greater number of emotional responses during Extinction agrees with the findings of others (e.g., Brackbill, 1958; Skinner, 1953; Verplanck, 1955). Because the responses labeled emotional occurred so infrequently and because observer-agreement measures were not made, no further statistical analysis seemed warranted.

ADDITIONAL FINDINGS

Performance of successive groups. It will be recalled that in any one experimental week the Ss were studied in groups of three or four. Inspection of the results suggests that in each successive group of each experiment an increasing number of Ss conformed to expectation, showing an increase in vocalizations during Conditioning and a decrease during Extinction. The *E*s apparently became more adept in executing the reinforcer as each experiment progressed.

PERFORMANCE OF INDIVIDUAL SUBJECTS

Although differences between experimental conditions have been demonstrated for the Ss as a group, the performance of individual Ss is of interest. Of the 22 Ss, 19 showed an increase in vocalizations under Conditioning. For 14 of these 19 the increase was significant at the .05 level, according to the Mann-Whitney Test (1947). Under Extinction, 16 of the 22 Ss showed some decrease, and for 10 of these 16 the decrease was significant at the .05 level.

Three Ss departed widely from the group pattern. For two, not only did Conditioning depress the rate of vocalizing, but Extinction restored it to its Baseline rate. The first chewed her thumb more during Conditioning than before or after. The second strained (in an apparent effort to defecate) during Conditioning whenever anyone, *E* or the nurse, leaned over his crib. Both activities precluded vocalizing. Both babies were very active, and it is possible, therefore, that in the very first Conditioning period *E* may have inadvertently reinforced these activities. For the third *S*, in Experiment I the experimental conditions appeared not to affect the frequency of vocalizations. Developmental immaturity seemed the most likely reason, for two weeks later he was studied again in Experiment II (the only *S* to be used in both experiments) with satisfactory results.

EFFECT OF BASELINE PERFORMANCE UPON CONDITIONING

The Ss tended to maintain their relative positions under Baseline and Conditioning. The rank-order coefficient of correlation (R) was .66, $p < .0005$. Further, the amount of gain under Conditioning was not correlated with original position ($R = .24, p > .05$).

Sex differences. The 12 male Ss gave slightly more vocalizations during Baseline and gained more under Conditioning than the 10 female Ss, but the differences were not reliable.

DISCUSSION

The results of these experiments suggest that:

1. Infants' vocal behavior in a social situation can be brought under experi-

mental control; that is, it appears to be conditionable.

2. A social event composed of an everyday complex of acts, performed by an adult who is not a caretaker, can function as a reinforcing stimulus.

3. The incidence of such behavior can be very quickly modified in as young an organism as the three-month-old infant.

ALTERNATIVE EXPLANATION

The question raised in the introduction may now be considered. Did the reinforcing stimulus function as an arouser of vocalizations? Would infants have vocalized more often because of the stimulation it provided, even if it had *not* been made contingent upon the infant's behavior? Or, did some part of the reinforcing stimulus (say, the smile) act as a social "releaser"? The findings appear to be compatible with the conclusion that conditioning occurred: The rate of vocalizing continued to rise on the second day of Conditioning; the rate did not fall to the Baseline level on the first day of Extinction; it continued to fall on the second day of Extinction; and Ss with low Baseline rates of vocalizing gained under Conditioning, although for them there was often a relatively long time interval (30 sec. or more) between the reinforcing stimulus and the occurrence of the next vocalization. Still, the decisive answer to the question must await an experiment in which the reinforcing stimulus is administered with equal frequency, but never directly after the infant vocalizes.

NATURE OF THE REINFORCER

The results seem to show that some everyday behavior of adults can function as a reinforcing stimulus for an infant. One would like to know from what sources its reinforcing properties arise. In the simplest case, the smiles, sounds, and caresses of adults may be reinforcing only because they provide a change in stimulation. Further information on this matter could be obtained by working with the separate parts of the reinforcing stimulus, one by one; by substituting for them lights or sounds dispensed by a machine; or by using a reinforcer of a less "affectionate" nature than the one used here appears to be. On the other hand, even for the three-month-old infant the smiles, sounds, and caresses of the adults may function as conditioned reinforcers because of their past association with caretaking acts.

It is possible that the Ss of this study, living in an institution, may have had a less rich experience with adults. Institutional babies were used as Ss only because they were more readily available, because more of them could be studied at one time, and because the complicating variable of differences in maternal care could be bypassed. They did not appear however to be "starved" for attention or affection. Indeed, the attendants were often observed responding to babies when they vocalized. While it is possible that mothers would respond more often, in the absence of a comparative study we believe that infants in general would respond as these infants did.

RELATION OF RESULTS TO THEORIES OF SPEECH

Since this study was limited to the vocalizing of infants in a social situation, attempts to reconcile the results with theories which account for all classes of prelinguistic utterances (babbling is the class frequently mentioned) cannot be complete. Thus, nothing in the findings of this study is incompatible with, for example, Holt's theory (1931) that the sound which the child hears himself make has reinforcing properties; with Lewis' theory (1951) that the adult's speech calls forth the infant's speech (a kind of imitation); or with Piaget's theory (1952) that vocalizing is perpetuated for its own sake by the processes of assimilation and accommodation. These may be labeled circular theories, for they do not postulate the necessity for any class of events prior to the moment when the infant responds to his own or another's vocalization. The theories of Miller and Dollard (1941) and of Mowrer (1950), on the other hand, are based upon the infant's associating the gratification of his needs and the accompanying vocalizations of the caretaker. Again, the results do not contradict this possibility.

The present study, however, does demonstrate the operation of still another principle: that the speech of the infant, if only in a social situation, can be modified by a response from the environment which is contingent upon his vocalizing. Hence, what happens *after* the infant vocalizes has been shown to be important.

SIGNIFICANCE OF RESULTS

On the basis of the results of these experiments it is seen that responses of adults which do not involve caretaking can affect the vocalizing of the young in a social setting. If the results can be extended to life situations, then mothers might be able to increase or decrease the vocal output of their children by the responses they make when the children vocalize. Other kinds of social behavior in addition to vocalizing behavior should respond similarly to conditioning. Brackbill (1958) has shown that smiling in the four-month-old infant may be increased when followed by a social response from an adult. It is likely that still other kinds of social behavior in babies, such as showing an interest in people, reaching out to them or turning away, perhaps even fear of the stranger, may also be affected by the responses adults make to them.

SUMMARY

Infants often vocalize as part of the response they give to the appearance of an adult. The central question of this study is: Can the frequency of vocalizing be increased if the adult makes a social response contingent upon it?

The Ss were 21 normal infants, three months of age, living in an institution. Eleven of them were studied in Experiment I with one *E*; 10 different Ss and one *S* from Experiment I were studied in Experiment II with a different E.

During the first and second Baseline days *E* leaned over *S* with an expressionless face, and the number of vocalizations was tallied. During the next two days, the first and second Conditioning days, *E* reinforced vocalizations by simultaneously smiling, clucking, and touching *S*'s abdomen. During the last two days, the first and second Extinction days, *E* returned to Baseline conditions.

The results indicated that: (*a*) there was no difference between Experiments, (*b*) Conditioning raised the rate of vocalizing above the Baseline level, (*c*) while Extinction lowered it until it approached the Baseline level.

The results suggest that the social vocalizing of infants and, more generally, their social responsiveness may be modified by the responses adults make to them.

REFERENCES

Brackbill, Y. Extinction of the smiling responses in infants as a function of reinforcement schedule. *Child Develpm.,* 1958, **29,** 115–124.

Gewirtz, J. L. A program of research on the dimensions and antecedents of emotional dependence. *Child Develpm.,* 1956, **27,** 205–221.

Holt, E. B. *Animal drive.* London: Williams & Norgate, 1931.

Lewis, M. M. *Infant speech: A study of the beginnings of language.* (2nd ed.) New York: Humanities Press, 1951.

Lindquist, E. F. *Design and analysis of experiments in psychology and education.* Boston: Houghton Mifflin, 1953.

Mann, H. B., & Whitney, D. R. On a test of whether one of two random variables is stochastically larger than the other. *Ann. Math Statist.,* 1947, **18,** 50–60.

Miller, N. E., & Dollard, J. *Social learning and imitation.* New Haven: Yale Univer. Press, 1941.

Mowrer, O. H. *Learning theory and personality dynamics.* New York: Ronald, 1950.

Piaget, J. *The origins of intelligence in children.* New York: Int. Univer. Press, 1952.

Rheingold, H. L. The modification of social responsiveness in institutional babies. *Monogr. Soc. Res. Child Develpm.,* 1956, **21,** No. 63 (No. 2).

Skinner, B. F. *Science and human behavior.* New York: Macmillan, 1953.

Verplanck, W. S. The control of the content of conversation: Reinforcement of statements of opinion. *J. abnorm. soc. Psychol.,* 1955, **51,** 668–676.

10.

Operant Conditioning of Continuous Speech in Young Children*[1, 2]

Suzanne Salzinger, Kurt Salzinger, Stephanie Portnoy, Judith Eckman, Pauline M. Bacon, Martin Deutsch, and Joseph Zubin

Although there is a fairly large literature concerned with the objective description of language in children (4), the categories used for such description, as well as the response units chosen for categorization, have been strictly empirically derived. Usually no theoretical background is used as a guide for the formulation of such categories or for the definition of the response units. One exception is Piaget (5) who does in fact make use of a theoretical framework for collecting information about speech development. However, his methods of experimentation are such that the response unit is never defined and would seem to be as much a function of the experimenter as the child. Another exception has been the work of Berko and Brown (1), who have made an excellent start in developing experimental techniques based on psycholinguistics for the purpose of eliciting verbal behavior from children in order to gain information about language structure. This work is a good example of a situation in which theory specifies the variables to be explored. Recently, Rheingold, Gewirtz, and Ross (6) conducted a study evolving from behavior theory in which they used operant conditioning techniques to control vocalization rate in infants. They found differences in vocalization rate as a function of reinforcement. The administration of reinforcing stimuli produced an increase in rate and the withdrawal of such reinforcing stimuli produced a decrease in rate. This indicates that the stimulus conditions operating while samples of vocalizations are being taken are critical for evaluating the results. Such stimulus conditions have seldom been adequately controlled in developmental studies on infant vocalization. Studies of speech acquisition with older children have lacked the same controls as the infant surveys.

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* From S. Salzinger, K. Salzinger, S. Portnoy, J. Eckman, P. M. Bacon, M. Deutsch, and J. Zubin, Operant conditioning of continuous speech in young children, *Child Develpm.,* **33,** 683–695 (1962). Reprinted by permission of the authors and the Society for Research in Child Development, Inc.

[1] Institute for Developmental Studies, New York Medical College. The research reported herein was partially supported through the Cooperative Research Program of the Office of Education, the United States Department of Health, Education, and Welfare, and partially supported by a grant from the Taconic Foundation to the Institute for Developmental Studies.

[2] Biometrics Research, New York State Department of Mental Hygiene and Columbia University. This study was supported in part by Research Grant M1541 from the National Institute of Mental Health of the National Institutes of Health, Public Health Service.

One of the problems in speech sampling has been that of the length of the samples. Usually results have been based on short samples, e.g., answers to interviewer questions on vocabulary tests or timed observations during free play situations. Furthermore, responses are generally not tape recorded, thereby barring the application of any reliability estimates.

The many studies of verbal behavior originating within the framework of operant conditioning (3, 7) have shown that the emission of verbal responses can be experimentally controlled by means of reinforcement. Also, as has been suggested by Salzinger (7), examination of the effects of the application of reinforcement to any response class, i.e., a group of words which is chosen and specified by the experimenter should allow us to test for the "natural" boundaries of that class, i.e., those words which actually do increase in frequency and those which do not. In this way it becomes possible to determine if there are any discrepancies between the response class as arbitrarily defined by the experimenter and the way the subject's verbal behavior actually changes as a result of reinforcement These "natural" classes may prove more useful as a developmental index than response classes prescribed by the experimenter.

The use of operant conditioning techniques in conjunction with special instructions has recently proved successful in evoking long samples of continuous speech (monologues) from schizophrenic adult patients (11). In the study to be reported below, a similar technique was used successfully to elicit samples of continuous speech from normal children. Factors relating to reinforcement schedule and response class were also dealt with.

A series of five experiments was conducted. The first was carried out as an exploratory study and concerned the question of whether speech rate could be modified by reinforcement. The second experiment tested the effect on speech rate of a specific type of reinforcement schedule, a variable ratio schedule. The third experiment was performed as a more extensive study on a different population in order to verify the results found in the first two studies, as well as to provide information on the effect of a fixed interval schedule on speech rate. The fourth experiment was carried out on the same population as the third, in order to examine the effects of reinforcement on a preselected specific response class. The fifth was done as a control study to see if changes in speech rate occurred in the absence of reinforcement.

Method

APPARATUS

The apparatus constructed for the delivery of reinforcement was a papier-mâché clown's head approximately 18 in. high, the nose of which was a 7½-watt red light bulb. This was mounted on a wooden stand and placed in a colorful box. The light could be switched on and off by the experimenter (*E*), and its occurrence was determined by different schedules of reinforcement. The click of the light switch was sufficiently loud to be tape recorded.

A tape recorder was used to record the child's speech as well as to deliver taped instructions to the child "from the clown."

During the last two experiments, a large burlap screen was placed on the table between the clown and the tape recorder in order to prevent completely the children from viewing either the recording apparatus or the two *E*s. During the first two studies the *E*s were partially hidden behind the clown's box. Although there was no evidence to suggest that the results of the first two studies were affected by the lack of screen, it was felt that the use of a screen might offer added control over the experimental conditions.

A stop watch was used to time the delivery of reinforcements.

Small toys were given as a final reinforcement after completion of each session.

PROCEDURE

Experiment I.

The sample consisted of nine children ranging in age from 5 to 7 years, from a private day nursery.[3]

Each child was brought into the experimental room, seated at a small table, and asked to draw a picture, first, of anything he wanted and then, of a clown. All his productions were verbally approved by *E*, in order to reinforce the emission of speech in the general situation.

The child was then told that the clown he had just drawn resembled one which had come to see him. He was then seated in front of the papier-maché clown and told that the clown would speak to him.

The clown then partly sang, partly spoke the following tape recorded instructions:

> I'm so happy. I'm so happy. I'm so ha-pa-pa-ha-pa-pa- happy (clown's nose lights up). Whoops, well hi there. My name is Happy (light). What's yours? (waits for child's reply). That's a nice name. Say, how do you like my new hat? (waits for reply). Well,

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[3] Thanks are due to Paul Tucker of the Flushing Progressive School for supplying us with nursery school subjects.

you know, I bought the hat especially for you boys and girls at this school. I'm so happy to be here (light). How do you like that! Every time I'm happy my nose lights up (light). Say, would you like to play a game with me? (waits for reply). Because we can have lots of fun together. Why don't you try to make me happy so my nose lights up? (light). All you have to do is talk to me, but only certain things you say will make me happy (light). You can tell me a story. You can tell me what you'd like to be when you grow up, what you do here in school, about your friends, and anything else you want to say to me. If you make me very very happy (light), you will get a special prize at the end of the game. See them over there? Now, do you understand the rules of the game? (waits for reply). You're supposed to talk to me and try to make me happy by getting my nose to light up (light). From now on, I'm not going to say anything. I'll only light up when you make me happy (light). Now you just wait a little bit and one of my assistants will tell you when to start. Okay?

The purpose of flashing the light whenever the clown said, "happy," was to establish the association between the light and the clown's being happy.

Two *E*s sat partially hidden behind the clown's box. The child was told to begin and, once he started talking, *E* reinforced the child's speech by lighting up the clown's nose according to a prearranged schedule.

There were three experimental periods: conditioning (ranging from 3 to 5 minutes), extinction (ranging from 1 to 3 minutes), and reconditioning (ranging from 4 to 5 minutes). During the first minute of the first conditioning period all speech was reinforced on a 2-second fixed interval schedule. This provided almost continuous reinforcement for the beginning of the session. During the remaining conditioning periods the response class was intermittently reinforced. It was defined to consist of all statements which included references to persons and pronouns (including references made to clowns and the child himself).

Prods were administered by *E* whenever the child ceased talking. Examples of the prods used were, "keep talking to the clown; try to make him happy; tell the clown a story; tell him something about your friends." Three out of nine children required prodding. The others spoke continuously until the end of the session.

Following the experimental session each child was given a small gift.

Experiment II

The sample consisted of seven children ranging in age from 5 to 6 years, who were taken from the same private nursery school as those in experiment I.

Each child was brought into the experimental room, seated at a small table, and read a story from a large colored picture book. The story and illustrations were devised specifically for the experiment and concerned a clown who was made happy only when children spoke to him. *E* asked the child questions about the story and reinforced all his replies by saying "mm-hmm," "that's right," etc.

The child was then seated in front of the clown and given the same tape recorded instructions as used in experiment I.

Five children were given 2 minutes of operant level, followed by 8 minutes of conditioning and 5 minutes of extinction. Two other children were given 2 minutes of operant level followed by 18 minutes of conditioning. Operant levels were kept short to prevent the children from extinguishing completely before reinforcements could be delivered.

Reinforcement of all speech was delivered on a variable ratio schedule. The basic speech unit was defined as 1 second of speech. A stopwatch was started when the child began talking and interrupted whenever the child stopped talking. When the cumulated amount of time spoken reached the value prescribed by the schedule, a reinforcement was delivered. Initially, all children worked on a 4:1 schedule, a mean of 4 seconds of speech being required for each reinforcement, with a range of 2 to 8 seconds of speech. They were then switched to an 8:1 schedule with a range of 4 to 12 seconds of speech.

Two of the children in this group required extensive prodding; the rest spoke continuously on their own. For this experiment the first prod was administered after a pause of 1 minute, successive prods being administered after 15-second pauses. All children were given a small gift after the experimental session.

Experiment III

The sample consisted of 23 children taken from the 1st grade of a New York City Public School.[4] The children ranged in age from 6 to 7 years.

This experiment was carried out in a different laboratory than the above two experiments, by two different *E*s.

Each child was seated at a small table and a specially devised colored story book was read to him which also dealt with a clown who liked to have children talk to him. *E* did not speak to the children except for reading the story.

The child was then seated at another table in front of a papier-mâché clown similar to the one used in the two former studies. A large screen behind the clown cut off the child's view of both *E*s and the tape recorder.

The child received the same tape recorded instructions as in the prior experiments.

Each session lasted 15 minutes, and consisted of 5 minutes of conditioning, 5 minutes of extinction, and 5 minutes of reconditioning. Reinforcement of all speech was delivered on a 10-second fixed interval schedule. This schedule is a relatively easy one to follow using a stopwatch where 10-second units are clearly and regularly marked.

Prods were administered only after pauses of 1 minute and these never, except as a last resort, elicited speech directly from the child. Instead, they were of the following type: "try to make the clown happy"; "the clown is sad"; "try to get Happy's nose to light up."

All children were given a small gift after the experimental session.

Experiment IV

The sample consisted of the same 23 children as in experiment III with the addition of two children whose data were not reported for that experiment because they had received a somewhat different procedure than the rest of the group.

In the present experiment, these 25 children were given the procedure already described for experiment III, except that a different response class was reinforced. In this case a specific response class was chosen consisting of statements which included the pronouns, "I," "we," "me," and "us." It was selected in order to yield information on the specificity or generality of the application of reinforcement to a specific response class imbedded within the more general class of continuous speech. Reinforcement was given on a regular 1:1 schedule, an attempt being made to reinforce as soon as possible after the occurrence of each of the first person pronouns.

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[4] Acknowledgment is made of the cooperation of the staff of Public School 16.

Experiment V

A small group of four children taken from the 1st grade in the public school was used.

The procedure was the same as that utilized in the two prior experiments except that no reinforcements were administered and all references to the clown's nose lighting up were omitted from the story and from the taped instructions. The children were thus told only that the clown would be made happy if they spoke to him.

The session lasted 15 minutes. Prods were administered only after pauses of 1 minute in length.

The children were given a gift at the end of the session.

Results

Data from all the experiments are summarized in Table 1. Due to differences in the length of time the children's behavior was sampled during each of the experiments, the basic data have been converted to word rate rather than absolute number of words.

EXPERIMENT I

A comparison of speech rate among the three experimental periods consisting of conditioning, extinction, and reconditioning was made, using the Friedman nonparametric analysis of variance (12). The difference among the three conditions was statistically significant ($p < .05$). The distribution of the sums of ranks for the three conditions was 16, 14, and 24. This indicates that a very small change occurred from conditioning to extinction and that the larger change occurred from extinction to reconditioning. Since the extinction periods for *S*s in this group were generally only 1 or 2 minutes long, it might be supposed that extinction never actually had a chance to take place. The effectiveness of the reinforcement seems more evident in the final reconditioning period where seven of the nine children showed an increase in speech rate.

EXPERIMENT II

A comparison of operant level, conditioning, and extinction was made for the five children given the same procedure, using the Friedman nonparametric analysis of variance. The total sums of ranks for these three periods were, respectively, 5, 12, and 13, and were statistically significant ($p = .03$).

This indicates that the largest change occurred from operant level to conditioning and that resistance to extinction was strong. The strength of the response might be accounted for by the fact that reinforcement was administered on a variable ratio schedule which customarily produces this effect.

The other two children in the group who were given an operant level of 2 minutes followed by 18 minutes of conditioning also showed an increase from operant level to conditioning.

A comparison of speech rate during the first periods was made between the nine children of experiment I and the seven children of experiment II in order to test the effect of initially administering reinforcement. The experiment I children received reinforcement and the experiment II children received no reinforcement

TABLE 1

Median Response Rates and Range of Responses for all Experimental Conditions

MEDIAN	RANGE	MEDIAN	RANGE	MEDIAN	RANGE	RESPONSE MEASURED	SAMPLE	*p* VALUE
Experiment I								
CONDITIONING		EXTINCTION		RECONDITIONING				
1.67	1.31–2.32	1.48	.83–2.48	1.80	1.21–2.50	words/sec.	Total	$p = .048$
Experiment II								
OPERANT LEVEL		CONDITIONING		EXTINCTION				
.67	.10–1.30	1.40	.30–1.71	1.35	.51–1.90	words/sec.	Total	$p = .024$
Experiment III								
CONDITIONING		EXTINCTION		RECONDITIONING				
.62	.04–2.77	.20	.07–2.49	.62	.00–2.30	words/sec.	Total	$.001 < p < .01$
.18	.04– .22	.11	.07– .19	.05	.00– .19	words/sec.	NTs*	$.125 < p < .273$
.85	.15–2.77	.44	.13–2.49	.77	.36–2.30	words/sec.	Total − (NTs)	$p < .001$
Experiment IV								
CONDITIONING		EXTINCTION		RECONDITIONING				
.78	.04–3.43	.54	.00–3.42	.68	.00–3.50	words/sec.	Total	$.02 < p < .05$
.07	.04– .17	.09	.00– .17	.16	.00– .24	words/sec.	NTs*	$p = .69$
.80	.23–1.99	.55	.20–1.96	.65	.14–2.09	words/sec.	$< 10\ S^R$†	$p = .62$
1.10	.39–3.43	1.12	.17–3.42	1.28	.36–3.50	words/sec.	Total − (NTs + $< 10\ S^R$)	$.02 < p < .05$
.03	.00– .47	.02	.00– .45	.06	.00– .47	pronouns/sec.‡	Total	$.001 < p < .01$
.01	.00– .02	.01	.00– .02	.01	.00– .03	pronouns/sec.‡	NTs*	$.95 < p < 1.00$
.01	.00– .03	.00	.00– .03	.01	.00– .04	pronouns/sec.‡	$< 10\ S^R$†	$p = .6$
.10	.00– .47	.06	.00– .45	.12	.06– .47	pronouns/sec.‡	Total − (NTs + $< 10\ S^R$)	$p < .001$
Experiment V								
1st 5 MINUTES		2nd 5 MINUTES		3rd 5 MINUTES				
1.05	.42–1.79	.63	.11–1.86	.58	.00–1.95	words/sec.	Total	$p = .43$

* Nontalkers.

† Children who received less than 10 reinforcements in both conditioning and reconditioning.

‡ First person pronouns.

From Salzinger, Salzinger, Portnoy, Eckman, Bacon, Deutsch, and Zubin, Operant conditioning of continuous speech in young children.

during the initial period. Speech rate was consistently higher for the experiment I children than for the experiment II children, the mean sums of ranks respectively being 10.7 and 5.7. The difference, tested by the Mann-Whitney unpaired replicates test (12), was statistically significant ($p = .025$, one-tailed test). When the 2-minute operant level of experiment II was compared with only the first 2 minutes of conditioning in experiment I, the same difference was found ($p = .015$).

EXPERIMENT III

A comparison of speech rate during conditioning, extinction, and reconditioning was made using the Friedman nonparametric analysis of variance. The sums of ranks for the three periods were 54.0, 32.5, and 51.5, respectively, the distribution being statistically significant ($.001 < p < .01$). Four of the 23 children were then separated from the group as "nontalkers," since all their speech had been elicited by prods. This group, when tested by the same statistical procedure, showed a distribution of sums of ranks of 10.5, 8.5, and 5, which was not statistically significant ($.12 < p < .27$). None of these subjects displayed a pattern that might be expected from the reinforcement contingencies. The remainder of the group consisted of 19 children all of whom spoke without prods. The distribution of sums of ranks for conditioning, extinction, and reconditioning was 43.5, 24, and 46.5, which was statistically significant ($p < .001$). Examination of the sums of ranks indicates that the withdrawal of reinforcement during extinction produced a consistently lower speech rate. Resistance to extinction was not as great for this group which was given fewer reinforcements on a fixed interval schedule as for the prior experimental group which had been given more reinforcements on a variable ratio schedule.

The children of the three experimental groups were compared on their rate of speech during the initial period. The first group was a conditioning group, given reinforcement on a 2-second fixed interval schedule for 2 minutes and an intermittent schedule the rest of the period. The second group was an operant level group where no reinforcement was administered, and the third group was a conditioning group with reinforcement given on a 10-second fixed interval schedule. The mean sums of ranks were 25.7 for the first group, 15.4 for the second group, and 15.3 for the third group. This distribution was tested for statistical significance by the Kruskal-Wallis one-way analysis of variance (12) and found to be significant ($.02 < p < .05$). Examination of the sums of ranks shows that the first group, which was given the most reinforcement, had the highest speech rate. The sums of ranks of the other two groups are the same.

EXPERIMENT IV

A comparison of speech rate among the three periods of conditioning, extinction, and reconditioning was made and found statistically significant ($.02 < p < .05$) using Friedman's analysis of variance. The distribution of sums of ranks was 50.5, 40.5, and 59. The 25 children in the group had been reinforced for statements including the pronouns I, we, me, and us. The same comparison was made for the five nontalkers in the group and was found not to be statistically significant ($p = .69$). The distribution of sums of ranks was 9.5, 8.5, and 12. Also statistically nonsignificant ($p = .62$) was a comparison of the three conditions based on the data from seven children, other than nontalkers, each of whom received less than 10 reinforcements in conditioning and in reconditioning. The distribution of the sums of ranks was 16, 12, and 14. The remainder of the group consisted of 13 children who spoke without prodding and who received 10 or more reinforcements during either conditioning or reconditioning. A statistically significant difference ($.02 < p < .05$) was found between conditioning, extinction, and reconditioning; the sums of ranks for these periods were, respectively, 25, 20, and 33. This result indicates that, although the reinforcement was applied to a specific response class, its actual effect was to increase a more general response class, namely, total speech rate, as though the reinforcement had been applied intermittently to that class.

An examination of the changes brought about by reinforcement in the response class of I-, we-, me-, and us-statements showed the same results as total speech rate. The entire group of 25 children showed a distribution of sums of ranks of 53, 36.5, and 60.5 ($.001 < p < .01$). The five nontalkers showed a distribution of 10, 9.5, and 10.5 ($.95 < p < 1.00$). The seven children who received less than 10 reinforcements showed a distribution of 16, 11.5, and 14.5 ($p = .6$). The remaining 13 children showed a distribution of 27, 15.5, and 35.5 ($p < .001$).

In order to check further on the apparent correlation between the specific class of personal pronouns which was regularly reinforced and the general class of total speech rate, a comparison was made of the total group of 25 children for the difference between conditioning, extinction, and reconditioning, based on the proportion of I-, we-, me-, and us-statements to total number of words. If the two response classes were highly correlated, then there should be no difference between these proportions for the three experimental conditions. This turned out to be the case, the distribution of the sums of ranks for the three conditions being 54, 43.5, and 52.5 ($.2 < p < .3$). Also, none of the three subgroups of children showed a significant difference between these proportions for the three conditions. For the five nontalkers, the sums of ranks for conditioning, extinction, and reconditioning were 11.5, 10, and 8.5 ($.69 < p < .95$); for the seven children receiving less than 10 reinforcements, they were 15.5, 12.5, and 14 ($p = .6$); for the remaining 13 children, they were 27, 21, and 30 ($.2 < p < .3$). Thus we see that in each subgroup, as well as in the total group, the specific response class (I, we, me, us) and the general one (amount of speech) were highly correlated and the evidence suggests that the reinforcement may have acted on the more general class as well as on the specific class.

EXPERIMENT V

Since no reinforcement was delivered during the experiment, an analysis of changes in total speech rate over time was done by dividing the session into three successive 5-minute periods. The distribution of sums of ranks over these three periods was 10, 8, and 6 ($p = .43$). Three of the children showed an extinction effect, speech rate decreasing steadily with time. The fourth child showed an increase in speech with time even though she started the session with a fairly high rate. No child showed the dip in speech rate during the middle 5 minutes which was characteristic of the children who were given extinction periods at that time.

DISCUSSION

The use of behavior theory for examining children's speech has yielded some interesting information. Treating speech as behavior in and of itself, and not as a symbolic representation of underlying meaning, has demonstrated lawful relationships which fit the general theoretical framework of behavior theory.

Examination of the effect of reinforcement on speech rate, when speech is considered a free operant, reveals the following: In all of the first four experimental situations where reinforcement was administered, an increase in rate occurred. A corresponding decrease in rate or stabilization at the previous conditioning rate occurred when it was withheld. This result was more pronounced when "nontalkers," i.e., subjects who did not speak without specific questioning or prodding by *E*, were removed from the group. Indeed, the speech of this nontalker subgroup could not be called a free operant.

It was also found that reinforcement produced a conditioning effect only if a minimum number of reinforcements was administered. This finding of a lower limit on the required number of reinforcements was also shown in a series of studies by Salzinger and Pisoni (8, 9, 10). For the present experiments reinforcement was not effective unless a subject was given at least 10 reinforcements. Subjects who receive less than the required number of reinforcements are probably equivalent to those who receive no reinforcements. For the latter no conditioning effect could be found, and in three out of the four children in experiment V, an extinction effect was found to occur with time.

Although changes in speech rate corresponded with those which were expected on the basis of the reinforcement procedures used, the effectiveness of reinforcement should be further tested during longer experimental sessions. For the present study, it was decided to run the children for a short time only to see if we could pick up the effect with a procedure which would not tax the children's attention span. At this time, further procedures are being devised so as to lengthen the sessions using older children.

The 5-minute extinction sessions for speech rate in experiments II, III, and IV produced different rates of response depending upon the procedures used. A few variables would be relevant for considering these differences in response strength. Behavior theory predicts greater resistance to extinction for variable than for regular scheduling, for ratio than for interval scheduling, and, finally, more extinction responses the greater the number of reinforcements administered (2). The group which showed the lowest response rate during extinction as well as the greatest decrease in rate from conditioning to extinction was that group which received the fewest reinforcements and which was also on a fixed interval schedule. The highest response rate occurred during extinction of the group which had been given variable ratio scheduling. The two groups where word rate was reinforced on a variable schedule showed no decrease from conditioning to extinction. These results indicate that all the above variables are operating on the extinction behavior and that further study, specifically designed to test separately for the differences in scheduling and number of reinforcements, is needed to evaluate the contribution of each factor. . . .

One further difference appears with regard to the speech rate of the children from the private nursery school and those from the public school. In general, it appears that the children from the private nursery school, most of whom come from professional middle class homes, were more verbally fluent than the public school children, who were primarily a lower socioeconomic group. The operant level for speech rate for the private school group in experiment II was just as high as the conditioning rate of the public school group. The conditioning speech rate for the private school group in experiment I was considerably higher than the conditioning speech rate of the public school group. The difference between the two groups of children can be further explained by a difference in the types and frequency of prods employed. More frequent and more direct prods might have increased the speech rate of the reluctant talkers in the private nursery school group.

SUMMARY

The spontaneous continuous speech of children ranging in age from 5 to 7 years was reinforced under various experimental conditions. The reinforcing apparatus consisted of a papier-mâché clown's head, the nose of which was a red light bulb.

The children were instructed to talk to the clown to make him happy and thereby get his nose to light up. The occurrence of the reinforcing light was made contingent upon different aspects of the children's speech in each experiment.

It was found that speech rate increased as a result of the administration of reinforcement and decreased or stabilized when reinforcement was withheld. Both the number of reinforcements delivered and the schedule appeared to produce differences in response strength. Reinforcements were not effective unless more than 10 were administered. The application of reinforcement to the response class of first person pronouns produced an increase not only in the specific class itself but also in general speech rate. A control group of children who were given no reinforcement showed no systematic changes in speech rate other than an extinction effect with time.

REFERENCES

1. Berko, J., & Brown, R. Psycholinguistic research methods. In P. H. Mussen (Ed.), *Handbook of research methods in child psychology*. Wiley, 1960. Pp. 517–557.
2. Ferster, C. B., & Skinner, B. F. *Schedules of reinforcement*. Appleton-Century-Crofts, 1957.
3. Krasner, L. Studies of the conditioning of verbal behavior. *Psychol. Bull.*, 1958, **55,** 148–170.
4. McCarthy, D. Language development in children. In L. Carmichael (Ed.), *Manual of child psychology*. Wiley, 1954. Pp. 492–630.
5. Piaget, J. *The language and thought of the child*. Routledge & Kegan Paul, 1952.
6. Rheingold, H. L., Gewirtz, J. L., & Ross, H. W. Social conditioning of vocalizations in the infant. *J. comp. physiol. Psychol.*, 1959, **52,** 68–73.
7. Salzinger, K. Experimental manipulation of verbal behavior: a review. *J. gen. Psychol.* 1959, **61,** 65–94.
8. Salzinger, K., & Pisoni, S. Reinforcement of verbal affect responses of schizophrenics during the clinical interview: the effect on conditioning of placement of the period of reinforcement. Paper read at Amer. Psychol. Assn., New York City, 1957.
9. Salzinger, K., & Pisoni, S. Verbal affect responses of schizophrenics as a function of number of reinforcements and

rate of acquisition. Paper read at Eastern Psychol. Assn., Philadelphia, 1958.

10. Salzinger, K., & Pisoni, S. Reinforcement of verbal affect responses of normal subjects during the interview. *J. abnorm. soc. Psychol.*, 1960, **60,** 127–130.
11. Salzinger, K., Pisoni, S., & Feldman, R. S. The experimental manipulation of continuous speech in schizophrenic patients. Paper read at Amer. Psychol. Assn., Chicago, 1960.
12. Siegel, S. *Nonparametric statistics for the behavioral sciences.* McGraw-Hill, 1956.

11.

Teaching Machines: An Application of Principles from the Laboratory*[1]

James G. Holland

Much has been said of teaching machines recently—but the emphasis has tended to be on the gadgets rather than on the much more significant development of a new technology of education initiated by B. F. Skinner (1954, 1958). The technology does use a device called a teaching machine, which presents a finely graded series of problems and provides immediate "reward" or reinforcement for the student's correct answers. But emphasis on machines has tended to obscure the more important facets of the new technology based on application of principles from the laboratory. The machines of today are not necessarily better than those of yesterday. Indeed, adequate machines could have been built hundreds of years ago. The movement today is not simply the mechanization of teaching, but instead the development of a new technology—a behavioral engineering of teaching procedures.

The history of unsuccessful teaching machines illustrates the relatively greater importance of the technique as opposed to the gadgets. The first teaching machine was patented 93 years ago. There have since been a series of patents and a promising burst of activity initiated by Sidney Pressey (1926) in the 1920's. None of these early efforts really caught hold. But during this period in which the idea of mechanized teaching has been latent, the science of behavior has developed principles which permit extremely precise control of behavior. This new technology is not only the so-called automation of teaching, but is an attempt to obtain the kind of behavioral control shown possible in the laboratory.

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* From J. G. Holland, Teaching machines: an application of principles from the laboratory, *J. exp. anal. Behav.*, **3,** 275–287 (1960). Reprinted by permission of the author and the *Journal of the Experimental Analysis of Behavior.*

[1] This article was invited by the editorial board. It was previously presented before the 1959 Invitation Conference on Testing Problems sponsored by the Educational Testing Service, and will appear in the *Proceeding of the Invitational Conference on Testing Problems* in 1960. The work discussed in this paper has been supported by grants from the Carnegie Corporation and the Ford Foundation.

We have, of course, seen other practical applications of scientific psychology. We are all familiar with the development of a technology of testing, which permits placing an individual in situations suited to his abilities. We are also familiar with another technology called human engineering, which fits machines and jobs to the capacities of man. One places a man in a job that suits him; the other alters the job to suit the man; *neither* attempts to alter or control man's behavior.

For years in the laboratory we have controlled the behavior of experimental subjects—both animal and human—by a widening array of principles and techniques. The new technology of education is the application of behavioral laws in modifying or controlling behavior. Such a technology became possible with the realization that we are actually referring to a verbal repertoire (Skinner, 1957) controlled by the same laws as other behavior. The old, defunct explanatory concepts of knowledge, meaning, mind, or symbolic processes have never offered the possibility of manipulation or control; but behavior, verbal or otherwise, can be controlled with ease and precision.

While machines are not the essential or defining aspect of this technology, they do play an important role in providing some of this fine control the technology requires. We will now examine several machines and notice the advantages they offer.

At Harvard there is a self-instruction room with ten booths, each containing a machine such as the one shown in Fig. 1. The students gets one set of material from the attendant and places it in the machine. He closes the machine and begins his studies.

This machine presents one item of material at a time. The subject reads the statement, which has one or more words missing, and he completes it by writing in the answer space. He then raises the lever and a small shutter opens, revealing the correct answer. Simultaneously, his answer is moved under glass, where it can be read and compared with the now-exposed correct answer. After comparing his answer with the correct answer, the student indicates to the machine, with an appropriate movement of the lever, whether his answer was correct or incorrect, and the next item appears in the window. He repeats all items answered wrong after he completes the set of items. He does not repeat correctly answered items.

A critical feature of the machine is that it provides immediate reinforcement for correct answers. Being correct is known to be a reinforcer for humans. In machine teaching, reinforcement is immediate. We know from laboratory work (Perin, 1943) that a delay between a response and its reinforcement of a few seconds will greatly reduce the effectiveness of the reinforcement. Adult human subjects can sustain at least small delays; nevertheless, any delay makes reinforcement less effective.

Although other techniques such as programmed workbooks (Homme & Glaser, 1959) and flashcards are sometimes used in this new behavioral technology, they offer less control. Teaching machines eliminate undesirable forms of responses which would also be successful in obtaining the right answer. For example, the teaching machine insures that the student answers before peeking at the indicated

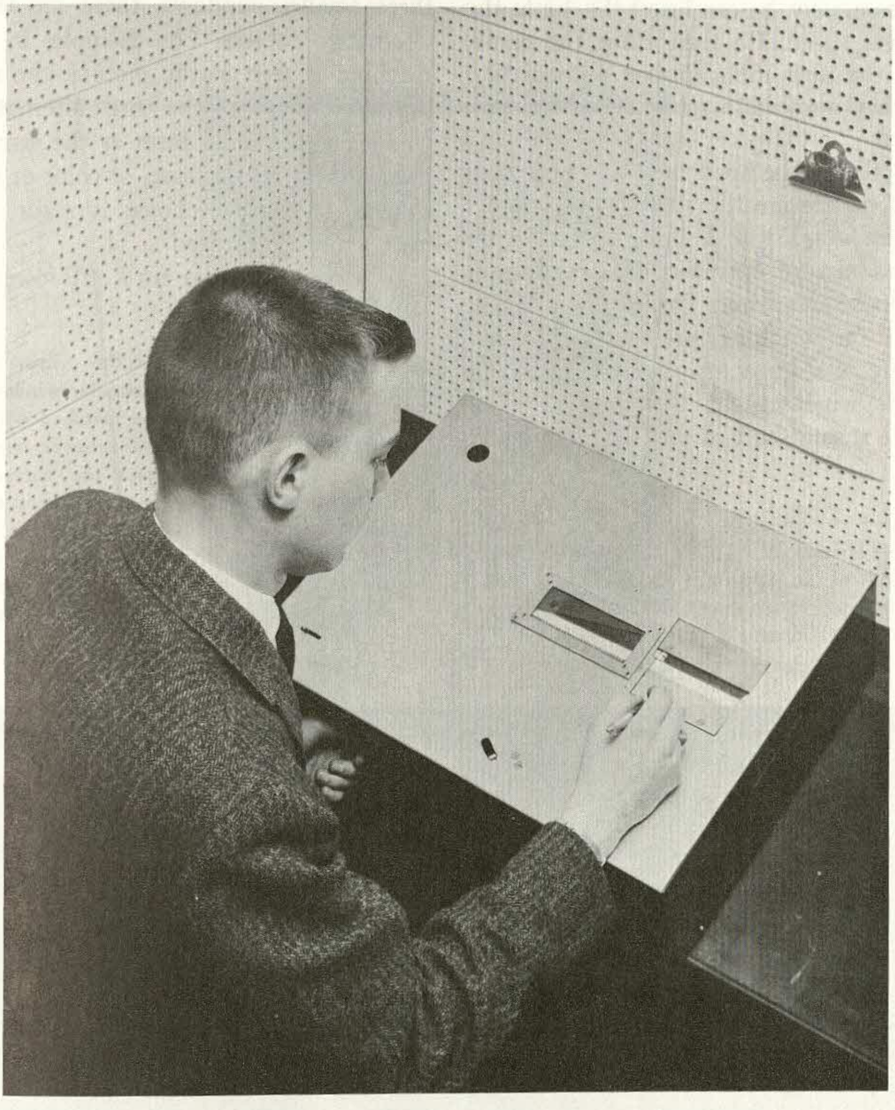


FIG. 1. Student working at a write-in teaching machine. From Holland: Teaching machines: an application of principles from the laboratory.

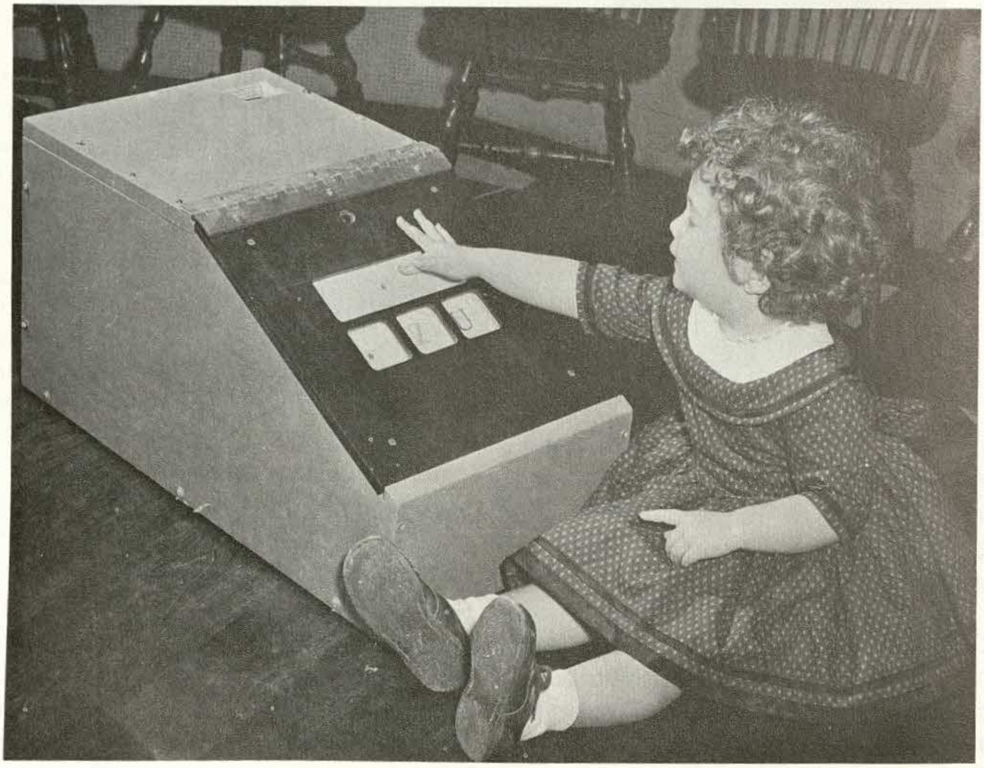
answer. There is a strong temptation to glance ahead with only a poorly formulated, unwritten answer when programmed workbooks or flashcards are used.

This write-in machine is a prototype of the most common machine. There is another machine used for teaching young children material which consistently has a single possible answer. In the machine the constructed answer is automatically compared with the true answer. The child is presented a problem, perhaps a statement such as $2 + 2 = \_\_$, and he must provide the 4. By moving a slider appropriately, he can insert the 4 into the answer space. He then turns the crank, and the next item appears immediately, so that immediate reinforcement is provided.

Both of the machines we have seen thus far require the student to compose the answer. Figure 2 shows a machine for a less mature organism who cannot yet compose an answer. This machine can be used for teaching preschool children.[2] There is a large top window and three small windows. In the large window, there is some sort of problem; and in the three smaller windows, there are three alternative choices. For example, in the machine as seen in the picture, the subject chooses one of the three alternatives which has the same form as the sample, independent, in this case, of color or size. When the correct choice is made, the next frame is presented.

A teaching machine for a still lower or-

FIG. 2. Child working on the preverbal machine. In the upper rectangular window is a sample which is to be matched with a figure in one of the three lower windows. If the child presses the correct lower window, the material advances to the next frame. In this case, the match is in terms of form, with size and color irrelevant. From Holland: Teaching machines: an application of principles from the laboratory.



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[2] Hively, W. An exploratory investigation of an apparatus for studying and teaching visual discrimination using preschool children. (In preparation.)

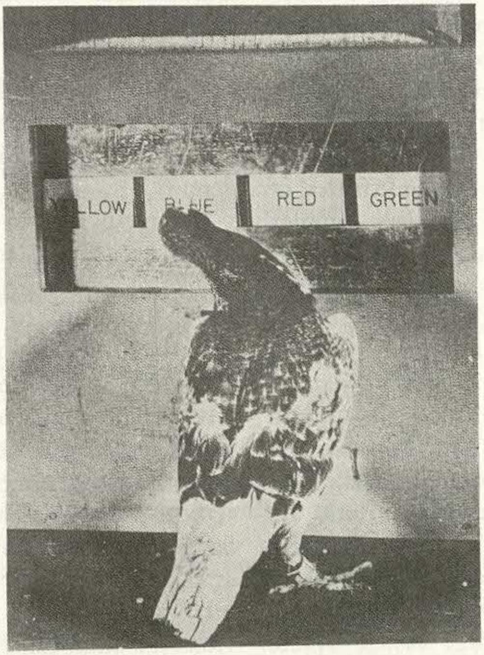

FIG. 3. A pigeon "naming colors." The pigeon pecks the color name corresponding to the color of the light projected above him. From Holland: Teaching machines: an application of principles from the laboratory.

ganism is shown in Fig. 3. This pigeon, with the aid of a teaching machine, has learned to hit the name plaque appropriate for a color projected above him. The principal difference between this and the other machines is that food reinforcement is used. With humans, simply being correct is sufficient reinforcement—pigeons will not work for such meager gains.

Enough of machines. They should not be allowed to obscure the truly important feature of the new technology, namely, the application of methods for behavioral control in developing programs for teaching. We need to say no more about the well-known principle of immediate reinforcement. Our second principle is also well known. Behavior is learned only when it is *emitted* and reinforced. But in the classroom, the student performs very little, verbally. However, while working with a machine, the student necessarily emits appropriate behavior, and this behavior is usually reinforced because the material is so designed that the student is usually correct. Not only is reinforcement needed for learning, but a high density of correct items is necessary because material which generates errors is punishing. Laboratory experiments (Azrin, 1956) have shown that punishment lowers the rate of the punished behavior. In our experience with teaching machines, we have also observed that students stop work when the material is so difficult that they make many errors. Furthermore, they become irritated, almost aggressive, when errors are made.

The third important principle is that of gradual progression to establish complex repertoires. A visitor once asked if Skinner had realized that pigeons were so smart before he began using them as subjects. The answer given by a helpful graduate student was that they weren't so smart before Skinner began using them. And indeed they weren't. The behavior developed in many experiments is like that developed in the classroom. Both are complex operants. Both require a careful program of gradual progression. We cannot wait for a student to describe the content of a psychology course before reinforcing the performance; nor can we wait for a pigeon to emit such an improbable bit of behavior as turning a circle, facing a disk on the wall, pecking it if lit, and then bending down to a now-exposed food tray and eating. When developing a complex performance in a pigeon, we may first reinforce simply the behavior of approaching the food tray when it is presented with a loud click. Later, the pigeon learns to peck a key which produces the click and the food tray. Still later, he may learn to peck this key only when it is lit, the peck being followed by the loud click and approach to the food tray. In the next step, he may learn to raise his head or hop from one foot to another, or walk a figure eight, in order to produce the lighted key which he then pecks; the click follows, and he approaches the food tray. This principle of gradual progression runs through many of the teaching-machine techniques. Both human and avian scholars deserve the same careful tutorage. The teaching-machine program moves in very finely graded steps, working from simple to an ever-higher level of complexity. Such a gradual development is illustrated in Table 1 by a few items taken from a psychology program.[3]

The principle of gradual progression serves not simply to make the student correct as often as possible, but it is also the fastest way to develop a complex repertoire. In fact, a new complex operant may never appear except through separately reinforcing members of a graded series (Keller & Schoenfeld, 1950). Only this way can we quickly create a *new pattern* of behavior. The pigeon would not have learned the complex sequence necessary to receive the food if it had not learned each step in its proper order. Obviously, a child can't begin with advanced mathematics, but neither can he begin with $2 + 2 = 4$—even this is too complex and requires a gradual progression.

Our fourth principle is, in a sense, another form of gradual progression—one which involves the gradual withdrawal of stimulus support. This we shall call fading. This method will be illustrated with some neuroanatomy material.[4] Figure 4A is a fully labelled cross section of the medulla oblongata. This is placed before the student while he works with a large set of items pertaining to the spatial

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[3] This program, prepared by J. G. Holland and B. F. Skinner, is entitled *A self-tutoring introduction to a science of behavior.*

[4] This material has been prepared by D. M. Brethower in collaboration with the present author, and it is being used at Harvard for research purposes.

TABLE 1

Items from the Psychology Program (11). These Items Illustrate the Gradual Development of a New Concept

ITEM	CORRECT ANSWER	PERCENTAGE OF STUDENTS GIVING THE ANSWER
1. Performing animals are sometimes trained with "rewards." The behavior of a hungry animal can be "rewarded" with ________.	Food	96
2. A technical term for "reward" is reinforcement. To "reward" an organism with food is to ________ it with food.	Reinforce	100
3. *Technically* speaking, a thirsty organism can be ________ with water.	Reinforced	100
50. A school teacher is likely, whenever possible, to dismiss a class when her students are rowdy because she has been ________ by elimination of the stimuli arising from a rowdy class.	Reinforced	92
51. The teacher who dismisses a class when it is rowdy causes the frequency of future rowdy behavior to (1) ________, since dismissal from class is probably a(n) (2) ________ for rowdy children.	(1) Increase (2) Reinforcement	86
54. If an airplane spotter never sees the kind of plane he is to spot, his frequency of scanning the sky (1) ________. In other words his "looking" behavior is (2) ________.	(1) Decreases (2) Extinguished (or: Not Reinforced)	94

From Holland: Teaching machines: an application of principles from the laboratory.

arrangement of the various structures. For example, "posterior to the cuneate nuclei are the ________." The answer is: "the cuneate fasciculi." After many such items, he begins another set and has another picture (Fig. 4B); but now the structures before him are labelled only with initials. A new set of items again asks a long series of questions pertaining to the spatial position of the various structures. For example, "between the gracile and the trigeminal nuclei are ________." The answer is the "cuneate nuclei." After many more items, he proceeds to a new set and the next picture. This time (Fig. 4C), the picture is unlabelled. Again, he goes through a series of new items, not simple repetitions of the previous ones, but items pertaining to the same problem of the spatial location of the different structures. This set is followed by still another but with no picture at all. He is now able to discuss the spatial position of the structures without any visual representations of the structures before him. In a sense, he has his own private map of the medulla. He may further demonstrate his newly acquired ability by accurately drawing the medulla. The neuroanatomy example is an elaborate example of fading. Fading is also applied in a more simple form in constructing verbal programs without pictorial displays. A single item may in one sentence give a definition or a general law and in a second sentence in that same item, an example in which a key word is omitted. This would be followed by a new example in the next frame, but with the definition or law lacking.

This brings us to our fifth principle: control of the student's observing and echoic behavior. In the classroom the student is often treated as though he were some kind of passive receiver of information, who can sop up information spoken by the teacher, written on the blackboard, or presented by films. But all of these are effective only insofar as the student has some behavior with respect to the material. He must listen carefully, or read carefully, thus engaging in usually covert echoic behavior. Ineffectiveness of classroom techniques is often credited to "inattention" or poor "concentration." It has been shown (Reid, 1953; Wyckoff, 1952) that if a discrimination is to be learned, adequate observing behavior must first be established. We have further found that observing behavior, or speaking loosely, "attention," is subject to the same forms of control as other behavior (Holland, 1958). This control of observing behavior is of prime importance. When the student becomes very "inattentive" in the classroom, the teaching material flows on; but with a machine, he moves ahead only as he finishes an item. Lapses in active participation result in nothing more than the machine sitting idle until the student continues. There is, however, a more subtle aspect to the control of observing behavior than this obvious mechanical one. In many of the examples we have seen, success in answering the problem depends only on the student's careful observation of the material in front of him at the moment. This may be illustrated by more material from the psychology program. A graph showing stimulus-generalization data is in front of the student while he works on the machine. In the program he may complete a statement: "As the wave length changes in either direction from the wave length present during reinforcement, the number of responses ________." The answer is "decreases." The item serves only to control the behavior of observing the data. Of course, many more such items are used to discuss the same data.

This principle of controlled observation extends to the details of writing a single item. For example, "Two events may have a common effect. An operant reinforced with two reinforcers appropriate to different deprivations will vary with ________ deprivations." The answer is "two" or "both." Here, the programmer's choice of the omission serves to insure a careful reading of the item. *Only* those parts of an item which must be read to correctly complete a blank can safely be assumed to be learned.

Our sixth principle deals with discrimination training. In learning spoken languages, for example, it is necessary to be

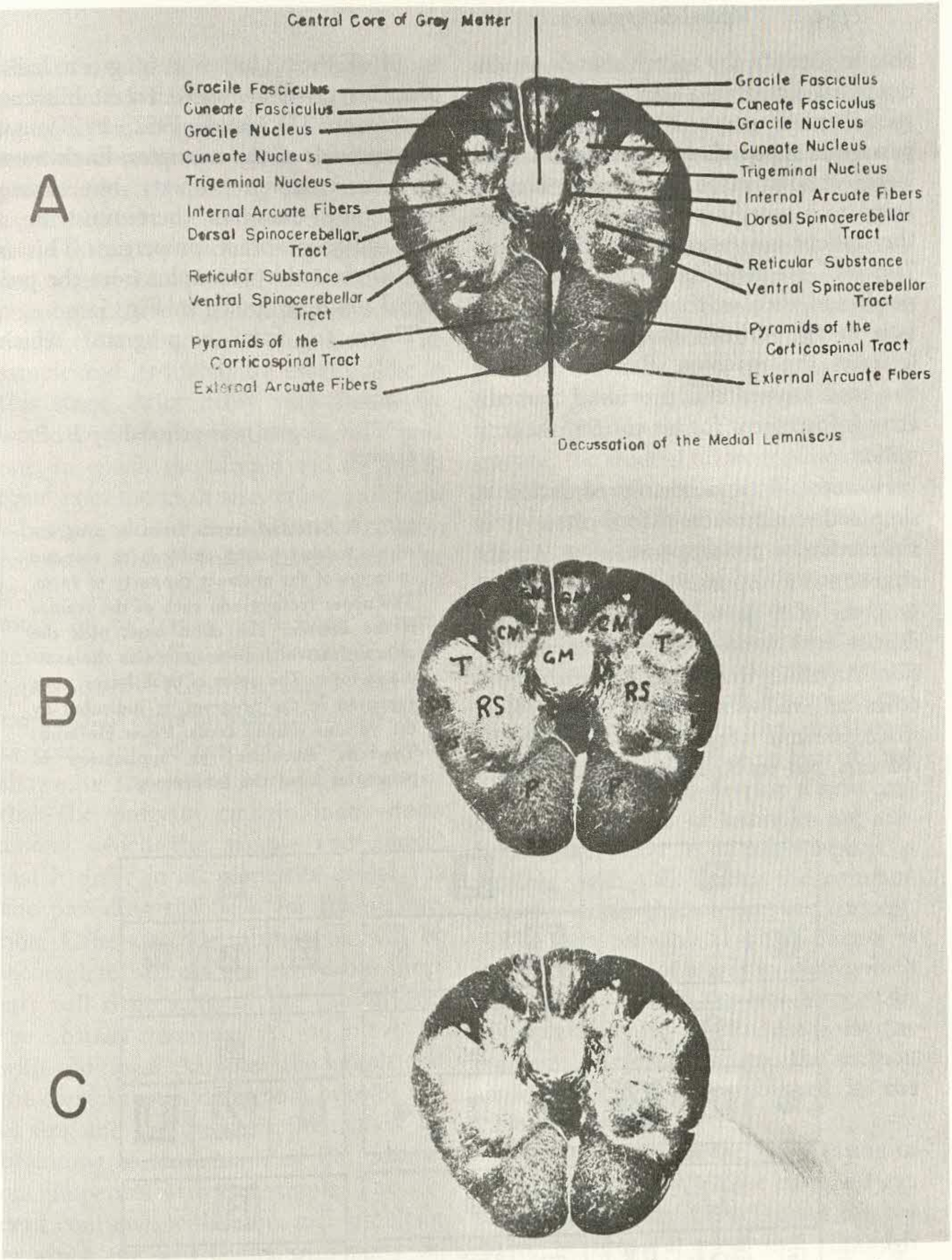


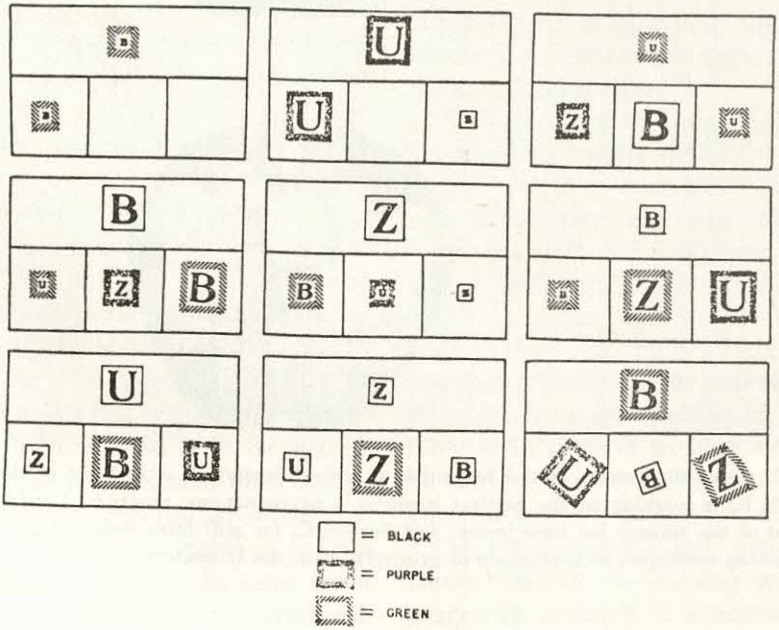
FIG. 4. An illustration of the technique of fading. Section A is in front of the student while he is working on the earliest items of a neuroanatomy program; Section B is in front of the student for later items; and Section C, for still later items. From Holland: Teaching machines: an application of principles from the laboratory.

able to identify the speech sounds. A student may listen to a pair of words on a special phonograph which repeats the passage as many times as he desires. The visual write-in machine instructs him to listen to a specific passage. For example, the student may hear two words such as: "sit, set." He listens as many times as he needs and then writes the phonetic symbols in the write-in machine. He then operates the machine, thereby exposing the true answer and providing immediate reinforcement for his correct discrimination.

However, little academic education is *simple* discrimination. More often, it is abstraction or concept formation. An abstraction is a response to a single isolated property of a stimulus. Such a property cannot exist alone. Redness is an abstraction. Anything that is red has other properties as well—size, shape, position in space, to name a few. There are red balls, red cars, red walls. The term red applies to all of them, but not to green balls, blue cars, or yellow walls. To establish an abstraction (Hovland, 1952, 1953), we must provide many examples. Each must have the common property, but among the various examples there must be a wide range of other properties. This is best illustrated by examples from the preverbal machine shown in Fig. 5.

These are from a program[5] which

FIG. 5. Selected items from a program which teaches young children to respond in terms of the abstract property of form. The upper rectangle in each of the frames is the sample. The child must pick the alternative which corresponds to the sample in form. The color of each letter, as it appeared in the program, is indicated by the various shaded areas. From Holland: Teaching machines: an application of principles from the laboratory.



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[5] This program was prepared by B. F. Skinner.

teaches a child to respond to the abstract property of form. In each item, the upper figure is the sample and the lower three are the alternatives. While developing a program for establishing an abstraction, we remember our earlier principles and move through a gradual progression. The first several items would be like the first one; here, there is a sample and a single match, the other two being blank. The sample and its match are exactly alike at this stage. After many such items, we would begin to have others like the next one, in which the sample and its match again correspond in size, color, and form —but an additional incorrect alternative has been added which differs from the sample in all these aspects. Later, we move on to frames with three choices; again, the sample and its match correspond exactly. Next, the sample and the match may differ in some property such as color, in the case of the next item shown, or size in the next. It is essential that the program contain many items among which the sample and correct match differ in all properties except the one providing the basis for the abstraction. Otherwise, the abstraction will be incomplete because the extraneous property will share some of the control over the abstract response. As we move on with additional examples, the sample and the correct match differ both in color and in size, and the incorrect alternatives are beginning to share some of the extraneous properties with the sample. The student continues with many such problems in which the only common property between the sample and the correct match is the shape, regardless of size and color. Even now our abstraction may be incomplete. We have kept the figures in only one orientation. Therefore, we also have a series in which the samples are rotated as in the next item. A great deal of academic education consists of trying to teach abstractions. Concepts such as force, reinforcement, supply and demand, freedom, and many, many other possible examples are all abstractions. Furthermore, in the academic setting, the student seldom adequately forms abstractions. The trigonometry student commonly uses triangles with the right angle as one of the two lower angles. If the triangle is rotated 90°, so that the right angle is upward, the student often does not recognize it as a right triangle. Neither is an abstraction developed simply by learning a definition. The psychology student who learns the definition of reinforcement in formal terms and is acquainted with a laboratory example of food reinforcement may not realize the horrible consequences of sending his girl friend flowers to end an argument. Thus, in the psychology program, we follow the pattern in the preverbal example to develop a new concept. Wide ranges of examples are analyzed which differ in as many aspects as possible, each still having the common property which characterizes the concept.

The last principle I shall discuss is really a question of a methodology which has served so well in the laboratory. This principle is to let the student write the program. A few years ago, the cartoon shown in Fig. 6 was published in the *Columbia Jester*.

The rat leaning on the bar is saying to the other rat: "Boy, do we have this guy conditioned. Every time I press the bar down, he drops a pellet in." Although said in jest, it is true that the rat controls the experimenter's behavior. When interesting things are observed about the rat's behavior, the control circuits are rewired to investigate the interesting new facet of

FIG. 6. ***"Boy, do we have this guy conditioned. Every time I press the bar down he drops a pellet in."*** **From Holland: Teaching machines: an application of principles from the laboratory.**

behavior. In a sense, the rat is wiring the control circuit. Similarly, the behavioral engineer who prepares good teaching-machine material must be under the control of the student's responses. When the student has trouble with part of a program, the programmer must correct this. The student's answers reveal ambiguities in items; they reveal gaps in the program and erroneous assumptions as to the student's background. The answers will show when the program is progressing too rapidly, when additional prompts are necessary, or when the programmer should try new techniques. When unexpected errors are made, they indicate deficiencies not in the student but in the program.

The most extensive experience with this principle of modifying the program to fit the student has been at Harvard with the psychology program. In 1958, we had a program consisting of 48 disks or lessons of 29 frames each. After using the program and making a detailed, item-by-item analysis of the students' answers, we diagnosed the particular deficiencies in the program and revised it accordingly. The program was also extended to cover a larger amount of subject matter; and in 1959, it consisted of 60 disks. You have already seen a few items from the course. After using the revised material in 1959, we evaluated the extent of its improvement. The next [table] shows the percentage of errors on the first 20 disks for each of the 2 years.

TABLE 2

A Comparison of the Students' Errors in Using the Revised (1959) and Unrevised (1958) Program in Psychology

	PERCENT ERRORS	PERCENT ITEMS IMPROPERLY SCORED BY STUDENTS
1958	20.1	3.6
1959	11.0	1.4

From Holland: Teaching machines: an application of principles from the laboratory.

The revision eliminated about half the errors. The last column of the table gives percentage of improper self-scoring by the students. Revision also cut these scoring errors approximately in half. Furthermore, the revision decreased the time required to complete the material. Although the second year's material had more disks—60 as opposed to 48—it actually required the average student about 1 hour less to complete the work than the shorter, first version had done. Frequency distributions on the median times in minutes for completion of the various disks are shown in Fig. 7. These are the times required for the median student to move through each set of material answering every item once and to repeat items answered incorrectly. Notice the considerable time required for many disks in the first year's material. Primarily, this was because students repeated the larger number of items missed in the first cycle.

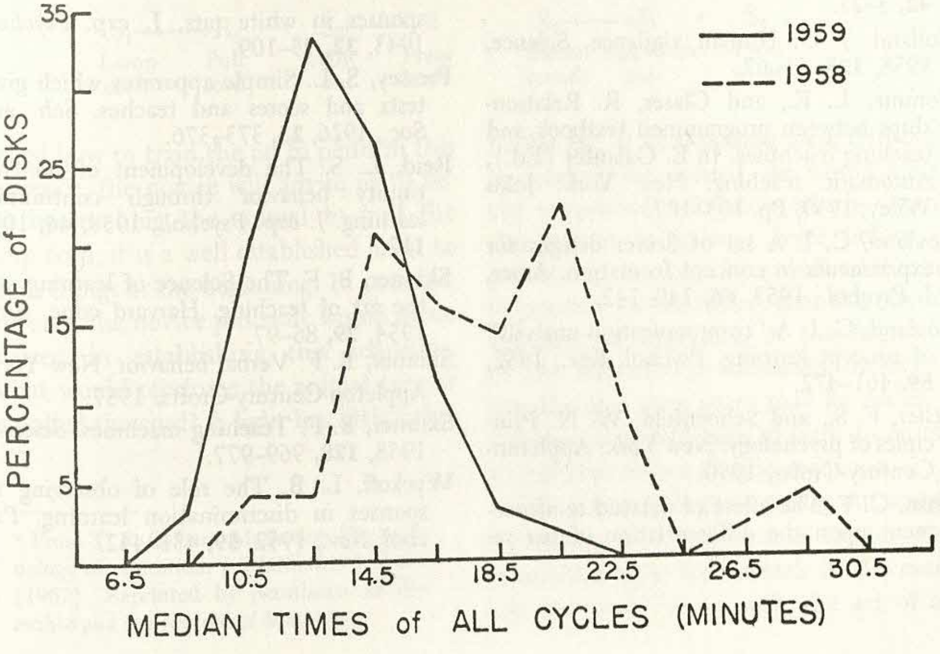
But the improved material provided faster performance, even when the delay due to repetition of incorrectly answered items is not considered. The frequency distributions for the first cycle only are provided in Fig. 8.

These data exclude the time used in repeating items. Here, too, the revision produced slightly more rapid progress.

Such careful tailoring of material to fit the student is impossible with most teaching techniques. With teaching machines, as in no other teaching technique, the programmer is able to revise his material in view of the students' particular difficulties. The student can write the program; he cannot write the textbook.

We have seen that the principles evolved from the laboratory study of behavior have provided the possibility for the behavioral engineering of teaching. This new technology is thoroughly grounded in some of the better-established facts of behavioral control. The future of education is bright if persons who prepare teaching-machine programs appreciate this, and appropriately educate themselves in a special, but truly *not* esoteric, discipline. But it is vital that we continue to apply these techniques in preparing programs. The ill-advised efforts of some of our friends, who automatize their courses without adopting the new technology, have an extremely good

FIG. 7. Frequency distributions for the median times to complete the disks or "lessons" for the revised (1959) and unvised (1958) psychology program. Raw frequencies were converted to percentages to equate the area under the curves. From Holland: Teaching machines: an application of principles from the laboratory.



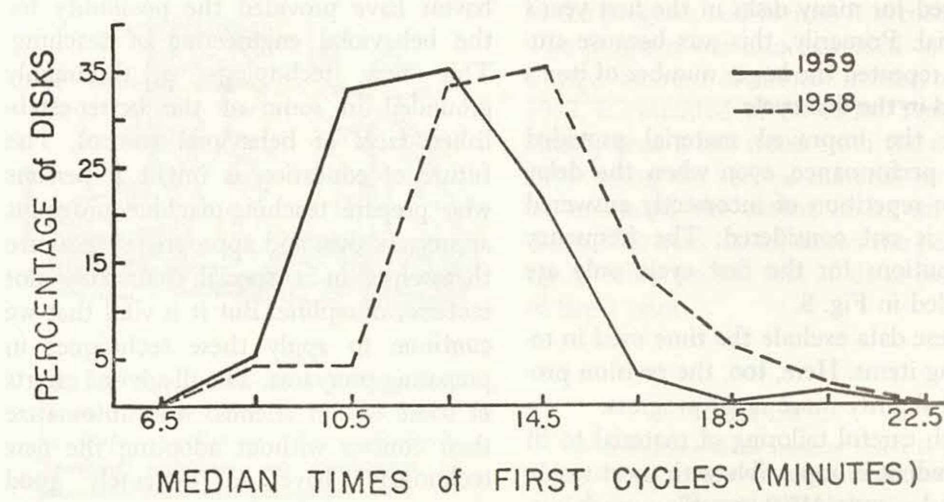


FIG. 8. Frequency distributions for the median times to complete only the first cycles for the revised (1959) and unrevised (1958) psychology program. Raw frequencies were converted to percentages to equate the area under the curves. From Holland: Teaching machines: an application of principles from the laboratory.

chance of burying the whole movement in an avalanche of teaching-machine tapes.

REFERENCES

Azrin, H. H. Some effects of two intermittent schedules of immediate and nonimmediate punishment. *J. Psychol.*, 1956, **42,** 3–21.

Holland, J. G. Human vigilance. *Science*, 1958, **128,** 61–67.

Homme, L. E., and Glaser, R. Relationships between programmed textbook and teaching machines. In E. Galanter (Ed.), *Automatic teaching*. New York: John Wiley, 1959, Pp. 103–107.

Hovland, C. I. A set of flower designs for experiments in concept formation. *Amer. J. Psychol.*, 1953, **66,** 140–142.

Hovland, C. I. A "communication analysis" of concept learning. *Psychol. Rev.*, 1952, **59,** 461–472.

Keller, F. S., and Schoenfeld, W. N. *Principles of psychology:* New York: Appleton-Century-Crofts, 1950.

Perin, C. T. The effect of delayed reinforcement upon the differentiation of bar responses in white rats. *J. exp. Psychol.*, 1943, **32,** 95–109.

Pressey, S. L. Simple apparatus which gives tests and scores and teaches. *Sch. and Soc.*, 1926, **23,** 373–376.

Reid, L. S. The development of noncontinuity behavior through continunity learning. *J. exp. Psychol.*, 1953, **46,** 107–112.

Skinner, B. F. The Science of learning and the art of teaching. *Harvard educ. Rev.*, 1954, **29,** 86–97.

Skinner, B. F. *Verbal behavior*. New York: Appleton-Century-Crofts, 1957.

Skinner, B. F. Teaching machines. *Science*, 1958, **128,** 969–977.

Wyckoff, L. B. The role of observing responses in discrimination learning. *Psychol. Rev.*, 1952, **59,** 431–442.

12.

Mathetics: The Technology of Education*

Thomas F. Gilbert

. . . Every exercise has the same basic structure, regardless of content. This structure has its basis in behavior principles. To understand the exercise model one must have an elementary grasp of the behavior principles of *chaining* and *conditioned reinforcement*. Although these principles are quite simple and obvious when understood, certain of their implications are so contrary to common thought that one must approach their understanding with care.

The nature of behavior chaining can be illustrated by a simple animal training problem. Suppose we wish to train a rat to perform, in sequence, these behaviors:

1st operant: Pull a lamp cord to light a light ($S_1 \longrightarrow R$)

2nd operant: Press a level until a buzzer sounds ($S_2 \longrightarrow R$)

3rd operant: Go to a food pan ($S_3 \longrightarrow R$)

This behavior chain can be represented in stimulus-response notation as:

$$\underset{\text{Lamp cord}}{S_1} \longrightarrow \underset{\text{Pull cord}}{R} \;\cdot\; \underset{\text{Light on}}{S_2} \longrightarrow \underset{\text{Press lever}}{R} \;\cdot\; \underset{\text{Buzzer sounds}}{S_3} \longrightarrow \underset{\text{Approach pan}}{R} \;\cdot\; \underset{\text{Food pellet}}{S_4} \;.\;.\;.\;.$$

Asked how to train the rat to perform this sequence, the novice will advise us to begin by teaching the animal to pull the lamp cord; it is a well established habit to begin things at the beginning. In practice, however, the novice probably would never succeed in establishing this sequence. What would reinforce the animal even if he pulled the cord? A light has little value to the rat. If cord-pulling were reinforced by feeding the animal, we would violate the sequential restriction which requires the animal to press a lever before approaching the pan. It is well established in practice and in theory that the obvious approach of beginning at the beginning of the sequence is extremely inefficient; months and even years may be added to the time it should take to train an animal to perform such a simple sequence.

We properly begin training our animal by starting with some act of mastery that is reinforcing to the animal. In the example we would begin with the act of approaching the food pan and finding food $(R \cdot S_4)$. We then teach the animal that food will not be found unless a buzzer is sounding. He learns that whenever he approaches the pan with the buzzer sounding, he gets reinforced. Now we have established this much mastery: $S_3 \longrightarrow R \cdot S_4$. Next, we provide for the lever to sound the buzzer; whenever the rat, in exploring the cage, presses the lever, he gets *immediately* reinforced. The immediate reinforcer is the buzzer itself; it is now reinforcing because it has become the occasion for approaching the food pan. Much of behavior science is based on this simple fact: an event that normally has no value to an animal will become reinforcing when it sets the occasion for a reinforcing act; we say that this event has become a *conditioned reinforcer*. With the conditioned reinforcement of the response of pressing the lever, we have established: $R \cdot S_3 \longrightarrow R \cdot S_4$. Next we teach the animal that the buzzer will not sound when the lever is pressed unless a light is on. Now we have $S_2 \longrightarrow R \cdot S_3 \longrightarrow R \cdot S_4$. It should be obvious how the remainder of the chain is produced, and that the light has become reinforcing by virtue of being an occasion for the buzzer working.

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* From T. F. Gilbert, Mathetics: The technology of education. *J. Mathetics,* **1,** 7–73 (1962). Reprinted by permission of the author and the *Journal of Mathetics.*

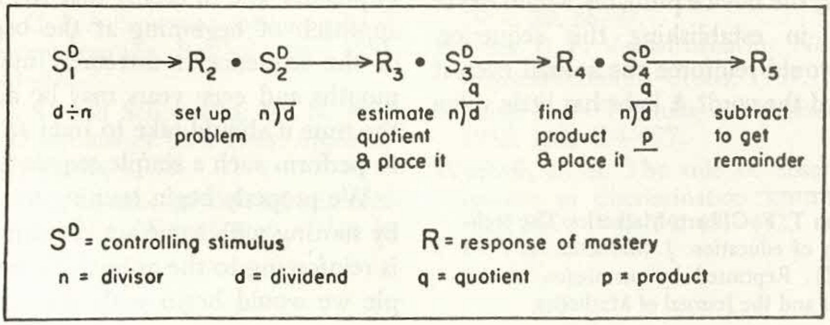
The principle of chaining derives from a fundamental of animal nature: You cannot teach an animal to do anything not already in his repertory. The word education is etymologically quite correct; existing behavior is *drawn out* of the animal and made more likely to occur again by consequences that are reinforcing. We establish the occasion (S^D) on which this behavior gets reinforced, then make it possible for the animal to produce this occasion, and so on through the chain.

Writing an Exercise

Consider a simple behavior chain such as performing long division. This behavior is represented in stimulus-response notation in Figure 1. The behavior has been oversimplified for illustrative purposes and letters are used to represent actual numbers. We shall assume the student knows short division, basic terminology, what to do with remainders and how to estimate quotients.

The principle of chaining tells us that we should first teach the student the terminal operant in the division chain: subtracting the product of quotient and divisor to obtain a remainder. The exer-

FIG. 1. Long division as a behavior chain. (Simplified for this example.) From Gilbert: Mathetics: The Technology of Education.


$S_1^D \longrightarrow R_2 \bullet S_2^D \longrightarrow R_3 \bullet S_3^D \longrightarrow R_4 \bullet S_4^D \longrightarrow R_5$
d÷n
set up problem
n)d
estimate quotient & place it
q over n)d
find product & place it
q over n)d, p
subtract to get remainder
S^D = controlling stimulus
R = response of mastery
n = divisor
d = dividend
q = quotient
p = product

cises in Figure 2 are simplified to illustrate the basic plan of all mathematical exercises; in actual lessons, the child would face an exercise looking very much like these, but prior instruction of the type described in a later section would be an important determinant of his success. In Figure 2, exercise #1 establishes the terminal operant of the chain described in Figure 1. Exercise #2 establishes the next to the last operant, and the operant before this is established in exercise #3. The entire model for exercises can be shown by these three exercises. An analysis of exercise #1 will reveal the model. In this exercise we are establishing the operant $S^D_4 \longrightarrow R_5$ (Subtracting to get the remainder). To establish this or any operant, three things are essential:

a) The [student] must be stimulated by S^D (he must attend to the appropriate stimulus or it is not really a stimulus at all).

b) The student must make the response while he is under the influence of S^D.

c) Immediately upon making the response, the student must see a result that is reinforcing to him.

In exercise #1 we have arranged these three conditions for the operant, $S^D_4 \longrightarrow R_5$.

First: We arrange for the student to observe the S^D (product in place under dividend). We do this by stimulating an observing response: $(S^O \longrightarrow R^O)$. In the exercise, part (a) and the solid arrow together constitute the observing stimulus (S^O).

Second: Some stimulus existing at strength for the response is used to get the response made. Usually, a simple verbal instruction (S^I) is an adequate stimulus for this purpose. In exercise #1, part (b) and the broken arrow serve as an (S^I).

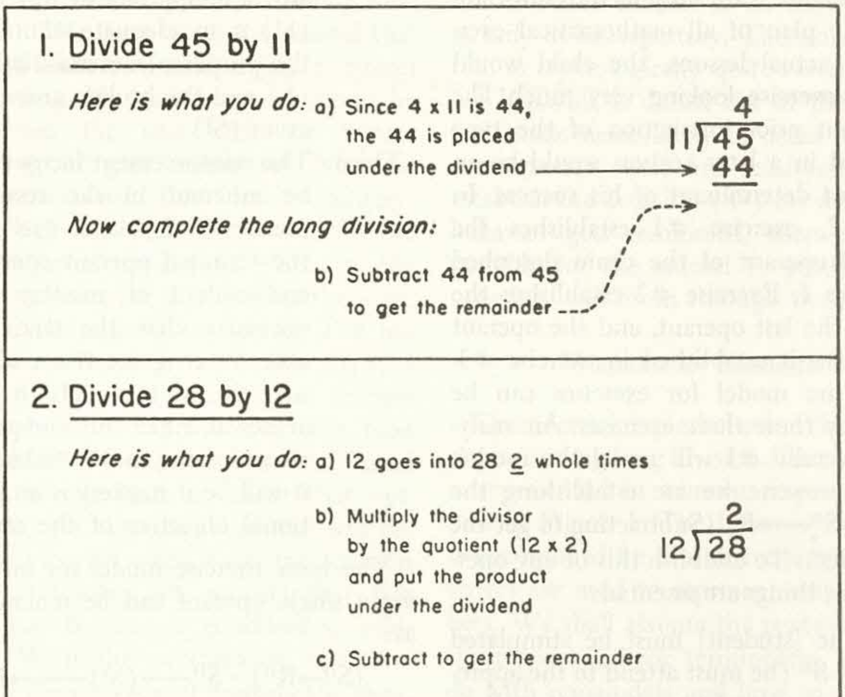
Third: The reinforcement factor should be inherent in the results of mastery performance itself; from the terminal operant comes the end-product of mastery. It is necessary that the student be able to recognize this end-product. It is assumed that the achievement of this end-product is reinforcing to the student, and it will be if mastery is an educational objective of the student.

The basic exercise model for introducing a single operant can be schematized as:

$$(S^O \rightarrow R^O) \cdot S^D \longrightarrow (S^I) \longrightarrow R.$$

The S^O is a stimulus for an observing response, designed to get the student to observe the S^D. S^I is a stimulus designed to produce the R, and it is usually a simple verbal instruction.

The observing stimulus (S^O) in the exercise model plays two roles, each representing fundamental properties of perception. S^O directs the student's attention to S^D, leading him to locate its physical topography. But locating the physical topography is not sufficient to establish the S^D; its identity, too, must be established. The number *44* in exercise #1 is a physical form that can, and does, perform many services in the experience of the student; it can have many identities. We do not want to establish R_n on the occasion of any even number or any multiple of 11, but we want it to come under the control of any product of the divisor and quotient. Observing S^D, therefore, means not only to locate the *44*, but



1. Divide 45 by 11

Here is what you do: a) Since 4 x 11 is 44, the 44 is placed under the dividend

Now complete the long division:

b) Subtract 44 from 45 to get the remainder

2. Divide 28 by 12

Here is what you do: a) 12 goes into 28 2 whole times

b) Multiply the divisor by the quotient (12 x 2) and put the product under the dividend

c) Subtract to get the remainder

3. Divide 33 by 15

a) 15 goes into 33 2 whole times

b) Put the 2 in place above the line

c) Multiply the divisor by the quotient and put the product in its place

d) Complete the division

FIG. 2. Exercises in long division (simplified) designed on the mathetical exercise model. From Gilbert: Mathetics: The Technology of Education.

to recognize its identity in this particular context. The two components of the S^O are, then, an attention-directing element and an identifying element, symbolized S^a and S^c, respectively. In exercise #1 of the example S^a functions through the solid arrow and the statement, "the 44 is placed under the dividend." The function of S^c is carried by "4 × 11 = 44" and the student's observation that 4 and 11 are the quotient and the dividend.

In exercise #2 of Figure 2, the next-to-last operant ($S_3 \longrightarrow R_4$) in the chain of long division mastery is treated as the last operant was in exercise #1. The reader should be able to locate the S^O and S^I for this operant. In all essential respects exer-

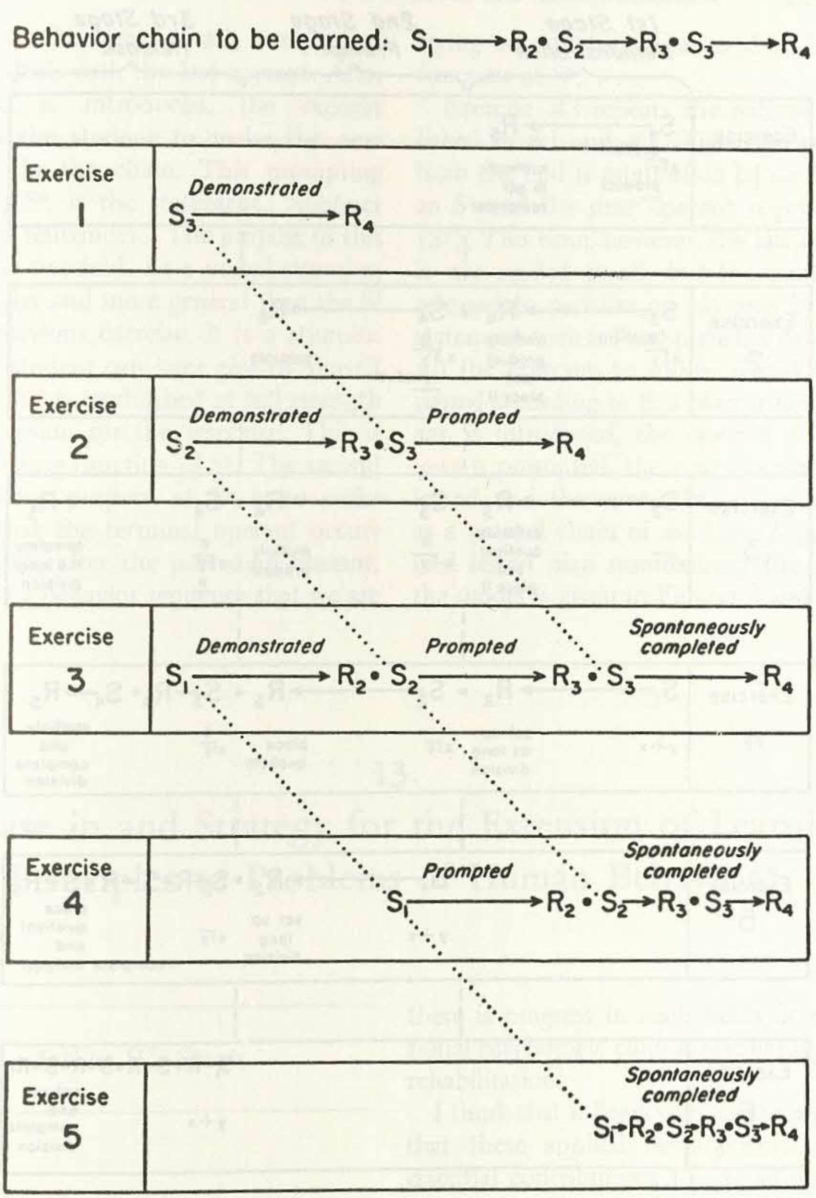

Behavior chain to be learned: $S_1 \rightarrow R_2 \cdot S_2 \rightarrow R_3 \cdot S_3 \rightarrow R_4$
Exercise 1
Demonstrated
$S_3 \rightarrow R_4$
Exercise 2
Demonstrated
Prompted
$S_2 \rightarrow R_3 \cdot S_3 \rightarrow R_4$
Exercise 3
Demonstrated
Prompted
Spontaneously completed
$S_1 \rightarrow R_2 \cdot S_2 \rightarrow R_3 \cdot S_3 \rightarrow R_4$
Exercise 4
Prompted
Spontaneously completed
$S_1 \rightarrow R_2 \cdot S_2 \rightarrow R_3 \cdot S_3 \rightarrow R_4$
Exercise 5
Spontaneously completed
$S_1 \rightarrow R_2 \cdot S_2 \rightarrow R_3 \cdot S_3 \rightarrow R_4$

FIG. 3. Skeleton of mathetical lesson plan. Beginning with terminal operant, each operant is (1) introduced with full demonstration, (2) prompted in the next exercise. (3) performed spontaneously thereafter. From Gilbert: Mathetics: The Technology of Education.

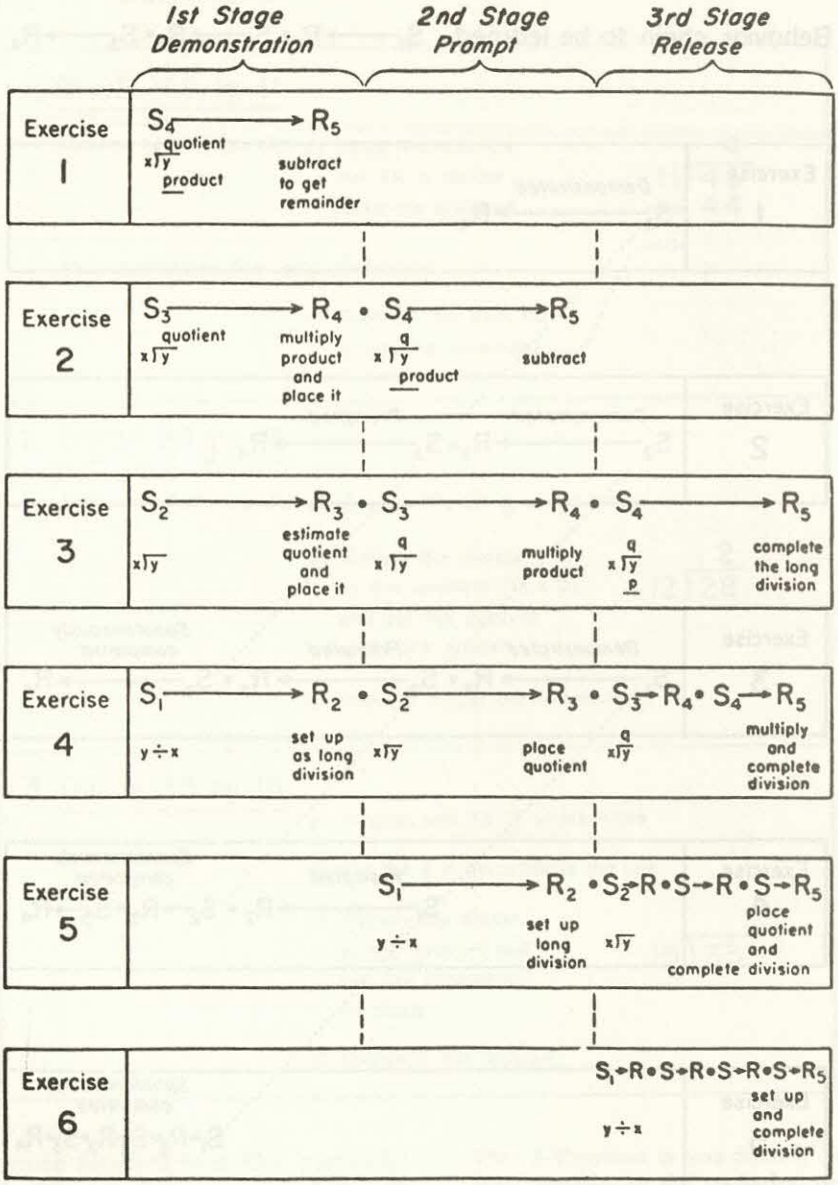

1st Stage
Demonstration
2nd Stage
Prompt
3rd Stage
Release
Exercise 1
S4 → R5
quotient
x)y
product
subtract to get remainder
Exercise 2
S3 → R4 • S4 → R5
quotient
x)y
multiply product and place it
q
x)y
product
subtract
Exercise 3
S2 → R3 • S3 → R4 • S4 → R5
x)y
estimate quotient and place it
q
x)y
multiply product
q
x)y
p
complete the long division
Exercise 4
S1 → R2 • S2 → R3 • S3 → R4 • S4 → R5
y ÷ x
set up as long division
x)y
place quotient
q
x)y
multiply and complete division
Exercise 5
S1 → R2 • S2 → R • S → R • S → R5
y ÷ x
set up long division
x)y
place quotient and complete division
Exercise 6
S1 → R • S → R • S → R • S → R5
y ÷ x
set up and complete division

FIG. 4. Schematic of lesson plan for long division, indicating the three stages of each exercise in developing a behavior chain. From Gilbert: Mathetics: The Technology of Education.

cise #2 is the same as #1, except that #2 also deals with the last operant. After $S_3 \longrightarrow R_4$ is introduced, the exercise prompts the student to make the next response in the chain. This prompting stimulus, S^p, is the statement, "subtract to get the remainder." The purpose of this prompt is two-fold. As a verbal stimulus, it is simpler and more general than the S^I in the previous exercise; it is a stimulus that the student can later give to himself until the S^D is established at full strength as an occasion for the response. This is the *mediating* function of S^p. The second and obvious purpose of S^p is to make certain that the terminal operant occurs immediately after the preceding operant, since it is a behavior sequence that we are trying to establish. This is the *chaining* function of S^p. . . .

Exercise #3 repeats the pattern established in #1 and #2. The third operant from the end is established by an S^O and an S^I and the next operant is prompted (S^p). This time, however, the last operant is not guided at all, but the student is released to perform on his own by some statement such as "complete the division." All the exercises to follow would be designed according to this plan; a new operant is introduced, the operant that follows is prompted, the next operant is released, and the remainder are performed as a natural chain of mastery. A generalized lesson plan summarizing the use of the model is given in Figures 3 and 4. . . .

13.

A Case in and Strategy for the Extension of Learning Principles to Problems of Human Behavior*[1]

Arthur W. Staats

. . . Relatively recently we have seen the extension of the principles and methods of learning to more complex cases, and a start has been made in the application of the principles and procedures to the treatment of practical problems. Although the full development of the practical application phase remains largely to be done, there is progress in such fields as educational psychology, clinical psychology, and rehabilitation.

I think that it bears stressing to indicate that these applied developments make essential contributions to the advance of the science from which they spring—in this case learning theory. In my view, when the principles of a science are relevant to practical problems of the world, one of the important criteria for evaluating the worth of the principles is the extent to which they aid in the solution of the problems. Thus, one way of furthering learning theory is to validate its principles and procedures within the context of solving a practical problem of behavior.

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* From A. W. Staats, A case in and strategy for the extension of learning principles to problems of human behavior, *Technical Report* No. 24 under contract Nonr-2794 (02).

I would expect these extensions of learning principles and methods to involve the following steps: (1) a learning analysis of the behavior and the circumstances under which it is acquired, (2) a demonstrational-type of experiment to verify the most significant principles in the area of study, (3) more systematic exploration of the various principles involved in that area, (4) the final application of these principles and the procedures which have been developed to the solution of the practical problems in the area.

It is in this mold that I consider the work I would like to report today—a project concerning the analysis of reading which has extended over a period of several years. I would like to use my experience on this project to suggest a general strategy with which to approach the extension of learning principles and procedures to the solution of problems of human behavior. To begin with, the behavioral analysis of the acquisition of a reading repertoire was based upon Skinner's (1957) interpretation of what he calls textual responses—operant vocal responses under the discriminated control of a printed or written verbal.

In our extension of this notion (Staats and Staats, 1962), we considered the acquisition of reading to involve getting the child to emit an appropriate vocal response while looking at a particular verbal symbol, then reinforcing the response. This training should establish the verbal symbol as a discriminative stimulus which controls the vocal response.

As part of the analysis we considered the way speech itself is acquired as compared to the way a reading repertoire is established, and it appeared that reading training is not nearly as propitious. Reading training, unlike what would be recommended by a learning analysis, is relatively intensive, and at the same time involves poor conditions of reinforcement—cause enough for many failures of training. Thus, as a first step, the analysis suggested that there are problems of training which might be eased by a better understanding of reinforcement within the context of reading acquisition.

The next step in the project was a demonstrational study which would grossly test the importance of reinforcement in this type of learning. In addition, such a study would explore the experimental population, and commence the development of procedures and apparatus. For this study (Staats, Staats, Schutz, and Wolf, 1962) a small group of words was arranged in a program in which words were presented singly as well as in sentences and in short paragraphs. The child was prompted to say a word as he looked

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[1] The present paper formed the basis for a lecture delivered on May 16, 1963, by the author, as part of a series held at the Palo Alto Veterans Administration Hospital. The series which was organized by Leonard Krasner and Leonard P. Ullmann will be edited by them and published by Holt, Rinehart and Winston. The lecture was entitled "Laboratory Study of Reading Acquisition: A Case in the Analysis of Complex Human Behavior." The project which is described herein is supported by the Office of Naval Research under contract Nonr-2794 (02).

at it, and was reinforced with small edibles, trinkets, or tokens backed up by small toys. Eight 40-minute training sessions were presented to the children and the number of new words the children learned to read was tested after each training session.

Three four-year-old children were introduced to the training without extrinsic reinforcement—they were given social reinforcers (i.e., approval) but not the other reinforcers. This was continued until the child requested discontinuance of the activity, which was only 15 minutes for two of the children and 15 minutes into the second session for the other child. At this point reinforcement was instated and in each case the child's reading behavior was strengthened and maintained for the remainder of the training. The records of these children are shown in Fig. 1. These children acquired 16, 17, or 17 word reading vocabularies in the eight training sessions.

Three other children were given the opposite treatment. That is, they were started under the reinforcement condition and after two training sessions were switched to no-reinforcement. As the figure shows they learned words readily under reinforcement, but when it was "cut off," their learning behaviors extinguished. After three or four sessions of no-reinforcement each child requested discontinuance and the condition was changed to reinforcement. In two cases the reading behavior was re-conditioned and learning "picked up" again. The records of these children are presented in Fig. 2.

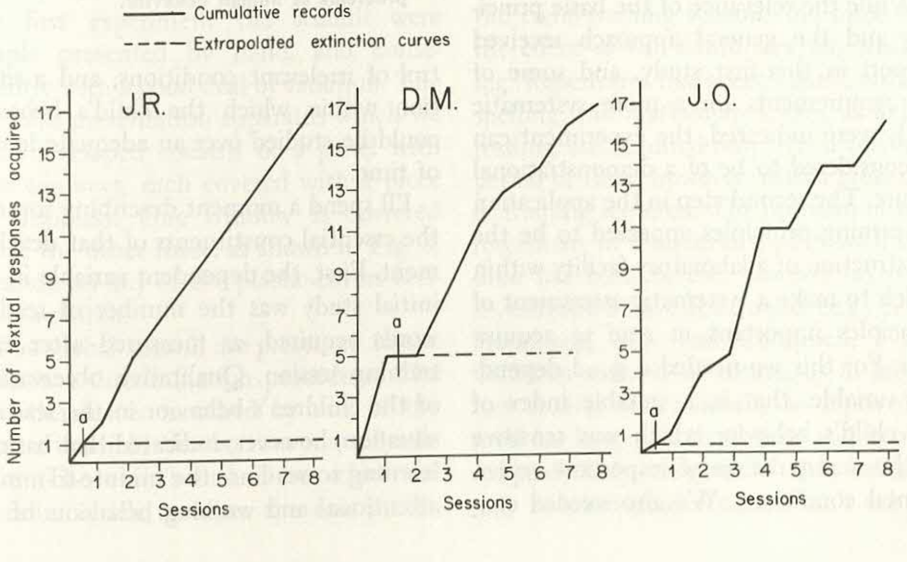


FIG. 1. The curves shown here were generated under a beginning period of no "extrinsic" reinforcement. When S would no longer remain in the experimental situation, reinforcement was instated as indicated by the mark on the curve. The dotted line commences at the point S would no longer remain in the experiment, and indicates the curve which would have resulted if reinforcement was not introduced. From Staats, A., A case in and strategy for the extension of learning principles to problems of human behavior.

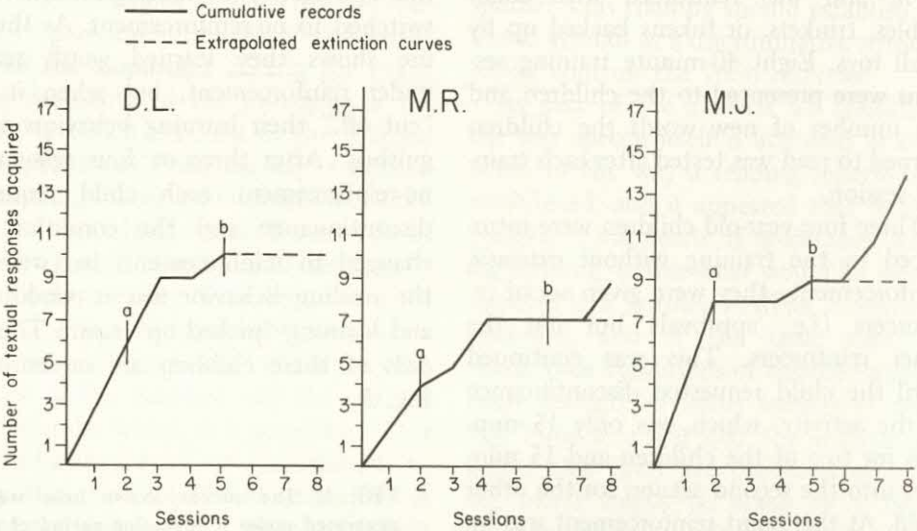


FIG. 2. For these Ss, the first condition included reinforcement which was discontinued at the point of the first mark on the curve. When S would no longer remain in the experimental situation, reinforcement was reinstated, as the second mark on the curve indicates. The dotted line commences at the point the S would no longer remain in the experiment and depicts the curve which would have resulted if reinforcement was not reinstated. From Staats, A., A case in and strategy for the extension of learning principles to problems of human behavior.

The results showed that when reading was reinforced attentional and work habits were strong and new words were learned rapidly, but both types of behavior deteriorated when reinforcement was not forthcoming. Thus, it would appear that under more appropriate conditions of reinforcement, even very young children are capable of sustained work activities and can learn complex verbal skills.

While the relevance of the basic principles and the general approach received support in this first study, and some of the requirements for a more systematic study were indicated, the experiment can be considered to be of a demonstrational nature. The second step in the application of learning principles appeared to be the construction of a laboratory facility within which to make a systematic assessment of principles important in reading acquisition. For this we needed a good dependent variable, that is, a suitable index of the child's behavior which was sensitive to the manipulation of important experimental conditions. We also needed control of irrelevant conditions, and a situation within which the child's behavior could be studied over an adequate length of time.

I'll spend a moment describing some of the essential constituents of that development. First, the dependent variable in the initial study was the number of reading words acquired, as measured after each training session. Qualitative observations of the children's behavior in the learning situation, however, indicated that basic to learning to read are the minute-to-minute attentional and working behaviors of the child. When the child attended to the material and worked at a high rate, he acquired new words rapidly. A record of these actual reading behaviors should result in a much more sensitive tool for testing the effects of different variables upon the learning. Accordingly, an experimental procedure was developed so that each reading response was automatically and cumulatively recorded by standard operant conditioning apparatus.

With reference to the control of irrelevant conditions, in the first study the materials were heterogeneous, consisting sometimes of words, sometimes of sentences, and sometimes of paragraphs. With the development of a minute-to-minute recording system it was necessary to have reading materials which themselves would not impose characteristics upon the child's rate of response. Thus, a program was developed consisting of single vowel and consonant-vowel combinations. Although the letters still differ somewhat in stimulus complexity or distinguishability from other letters, response variability was markedly decreased.

In addition, an apparatus for the presentation of the stimuli was required. In the first experiment the stimuli were simply presented by hand, and consequently with a good deal of variation. The stimulus presentation apparatus which we later developed consists of a panel with four windows, each covered with a piece of plexiglass. One window is centered above the other three, as shown in Fig. 3. Pressure on any of the plastic covers activates a switch.

The verbal stimuli are presented to the child in a discrimination procedure. The top stimulus is matched by one of the three stimuli in the bottom row of windows. The child's task is to select the stimulus which matches the one in the top window. In the procedure the stimuli are presented, and the experimenter, who is almost entirely hidden from the child, "names" the top stimulus after the stimulus has been presented for 10 seconds. The child must echo the name and press the plastic cover on the window. He must then select the matching stimulus from among the bottom windows, say the stimulus name again and press the plastic cover. When this response occurs correctly, the child is automatically and immediately reinforced. An error at any point in the chain automatically activates the apparatus so that the child must begin the trial over from the beginning—this insures that only correct responses are reinforced. Since the verbal stimuli are periodically repeated, after a time the child's vocal response may come under the control of the stimulus and the child may without prompting emit the appropriate sound within the 10-second delay period. In this case the child is immediately reinforced and does not have to go through the whole chain of responses.

While the reinforcement system used in the demonstrational study was adequate for that purpose, the results over the eight training sessions indicated that the effect of the reinforcers was weakening. Repertoires like speech itself, writing, spelling, and mathematics, etc., as well as reading, are acquired only over a very long period of time, however, with a great deal of training required. The problem of reinforcement in long-term studies with children has been severe, however, as other investigator's have also found (e.g., Long, Hammack, May and Campbell, 1958). Children cannot, of course, as in laboratory studies with animals, be deprived of food for long periods of time and kept at reduced body weight, so that research may be conducted. And we can't use the

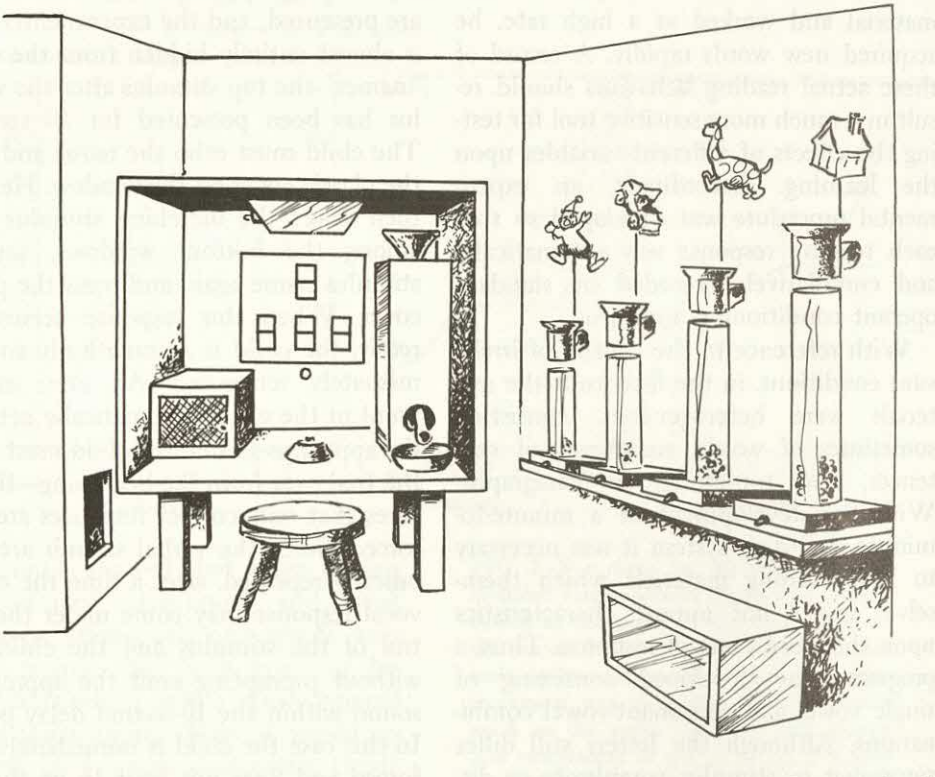


FIG. 3. The laboratory apparatus for the experimental study of reading behavior. The child is seated before the center panel within easy reach of the various manipulanda which are involved in the reading response sequence. Letter stimuli appear in the small plexiglass windows in front of the child whenever he activates the pushbutton on the table before him. If a correct reading response sequence then occurs, the marble dispenser located at the child's near-right drops a marble into a tray positioned at its base. To the child's left is an open bin in the Universal Feeder cabinet into which are delivered trinkets, edibles, or pennies, whenever the child deposits a marble in the funnel located atop the marble dispenser. A marble may also be "spent" for toys displayed at the child's far-right. Whenever the plexiglass tube beneath a toy is filled with marbles the child receives that toy. An intercom speaker at the child's left allows his vocal behavior to be monitored from outside the experimental chamber. The light at the top of the center panel was not used in this study. From Staats, A., A case in and strategy for the extension of learning principles to problems of human behavior.

withdrawal of aversive stimulation as a source of reinforcement. One of the things we see on the basis of naturalistic observation, however, is that tokens, like money, become excellent reinforcers for people—even without states of deprivation for primary reinforcers. This occurs because money is paired with, or backed up by, a large number of other reinforcers. Taking this tip from everyday life, a reinforcer system following the same principle was developed. This consisted of tokens backed up by various items which the children had previously selected—the ratio of tokens to back-up reinforcers dictated by the capacity of the tube in which the tokens are deposited (see Fig. 3).

The next step in the experimental analysis of reading acquisition was to test the combined apparatus and procedure. While each phase of developing the laboratory facility involved pilot work, it was important to determine whether the entire system would maintain the child's behavior for a long enough period of time to study significant variables in the learning process, to see if the stimulus materials and apparatus produced control of attentional responses, to establish the feasibility of cumulative recording, and to note the sensitivity of the records, and so on. The learning curves of two children run for 40 daily twenty-minute training sessions under conditions of continuous reinforcement will be presented (Staats, Minke, Finley, Wolf and Brooks, 1964). The first child's record is one of great consistency following the preliminary training sessions (see Fig. 4). For this child the tokens appeared to immediately constitute strong and invariant reinforcers. That is, this child customarily deposited his tokens in the tubes for the larger toys, which meant that several times his behavior was maintained for as many as three daily sessions with no back-up reinforcers—only tokens. The second child's working behavior in the reading training was more variable, including pauses of various intervals (see Fig. 5).

The results for these children indicate that the various procedural developments were functional in producing a laboratory situation within which to study the complex human learning of a reading repertoire. Long-term studies now appear to be possible as each of these two children emitted about 1500 reading responses in the 40 days of training.

The next step in the systematic analysis was to use the laboratory facility to begin to assess variables important to the acquisition of the behavior. As part of this, also, there was the need to test the extent to which the facility was well enough controlled to be sensitive to the manipulation of important independent variables.

An important variable needing more systematic study concerns the schedule of reinforcement. We know from more basic studies that certain schedules of reinforcement will produce better working behaviors than others. On a practical level of dealing with children's learning, can we improve the rate of response by reinforcement scheduling variables when complex learning is involved? Related to this is also a second goal of improving the reinforcer system. That is, it would be advisable to minimize the delivery of reinforcers to prevent satiation. Anything which postpones satiation can be considered to increase the effect of the reinforcer system, and intermittent reinforcement would reduce reinforcer expenditure.

Our next study (Staats, Finley, Minke, and Wolf, 1964), using additional children, was oriented towards these questions. We applied two different schedules of reinforcement to each of our subjects and compared rates of response under each schedule. The procedure was that of discrimination learning: the child was reinforced in one manner under one room-light condition, and in another manner under another room-light condition. These light-reinforcement conditions were alternated during each training session in a manner which has been referred to as a multiple schedule (Ferster and Skinner, 1957; Orlando and Bijou, 1960).

The first child was run under continuous reinforcement for one light condition and under extinction—no reinforcement

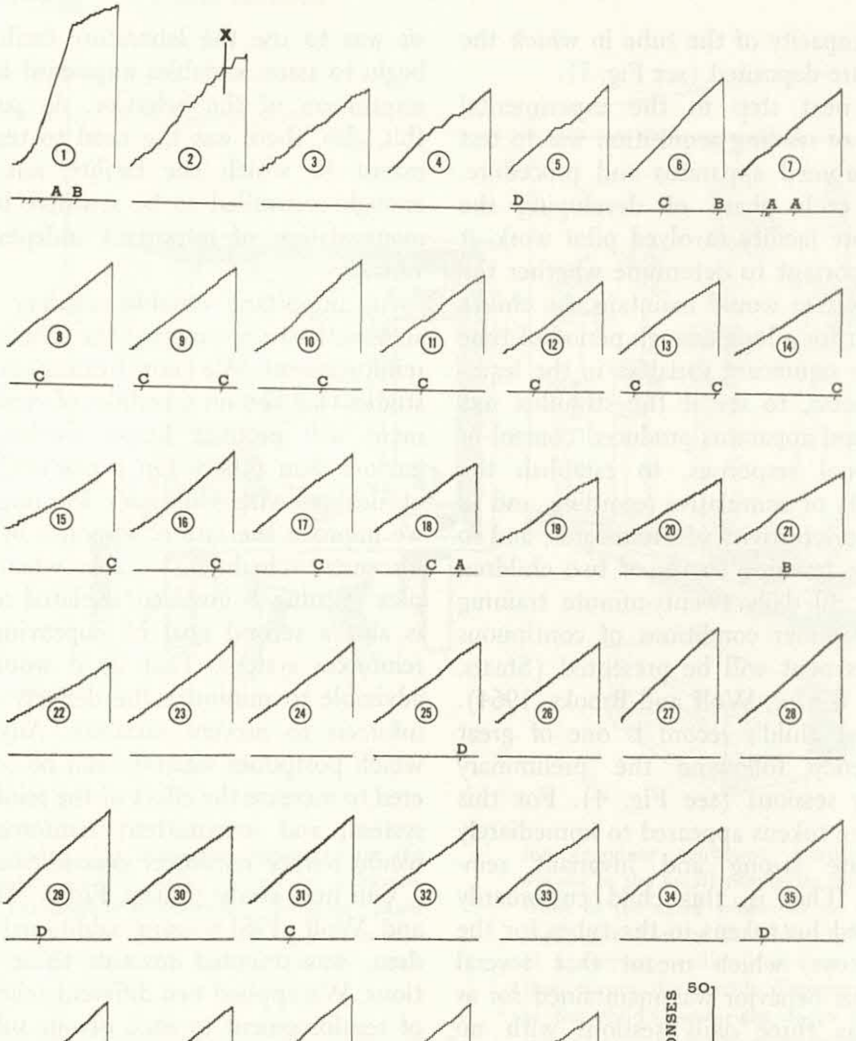


FIG. 4. Cumulative records by sessions for Subject #1. Responses made prior to point *X* in Session 2 are those occurring during various pretraining phases. Point *X* marks the beginning of the actual reading task. The slash marks located on the line below each curve represent the presentation of various back-up reinforcers. *A* indicates that a $.10 toy was exchanged for 10 marbles; *B* marks the presentation of a $.35 toy in exchange for 35 marbles; the child's exchange of 80 marbles for a toy is denoted by a *C*; *D* marks the exchange of 150 marbles for a toy; unlettered slash marks indicate that the child deposited a marble for some item from the Universal Feeder. From Staats, A., A case in and strategy for the extension of learning principles to problems of human behavior.

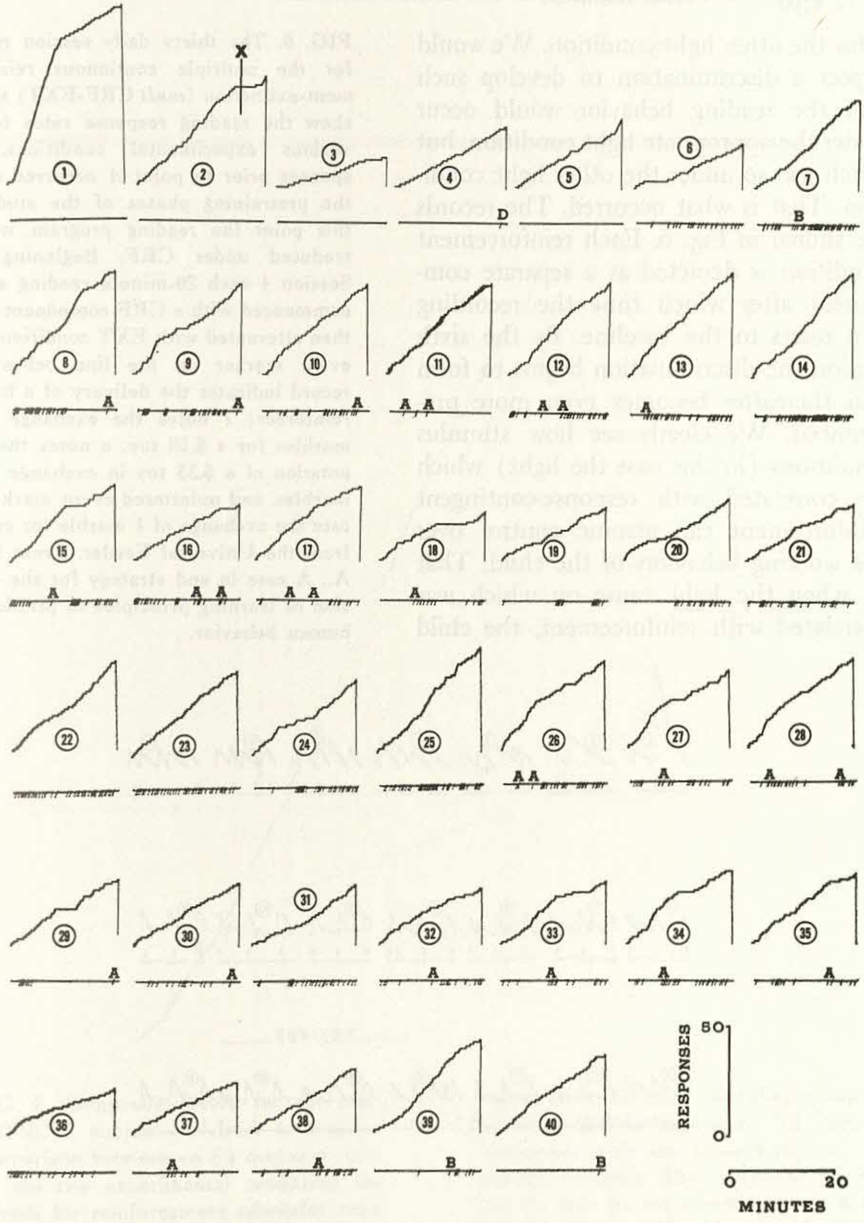


FIG. 5. The cumulative records by sessions for Subject #2. The sequence of pretraining tasks occurs until point *X*, at which time the reading program was introduced. The occurrence of back-up reinforcers is indicated below each curve as on the previous subject's records. From Staats, A., A case in and strategy for the extension of learning principles to problems of human behavior.

—for the other light condition. We would expect a discrimination to develop such that the reading behavior would occur under the appropriate light condition, but much less so under the other light condition. That is what occurred. The records are shown in Fig. 6. Each reinforcement condition is depicted as a separate component after which time the recording pen resets to the baseline. By the sixth session the discrimination begins to form and thereafter becomes even more pronounced. We clearly see how stimulus conditions (in this case the light) which are correlated with response-contingent reinforcement can assume control over the working behaviors of the child. That is, when the light came on which was correlated with reinforcement, the child

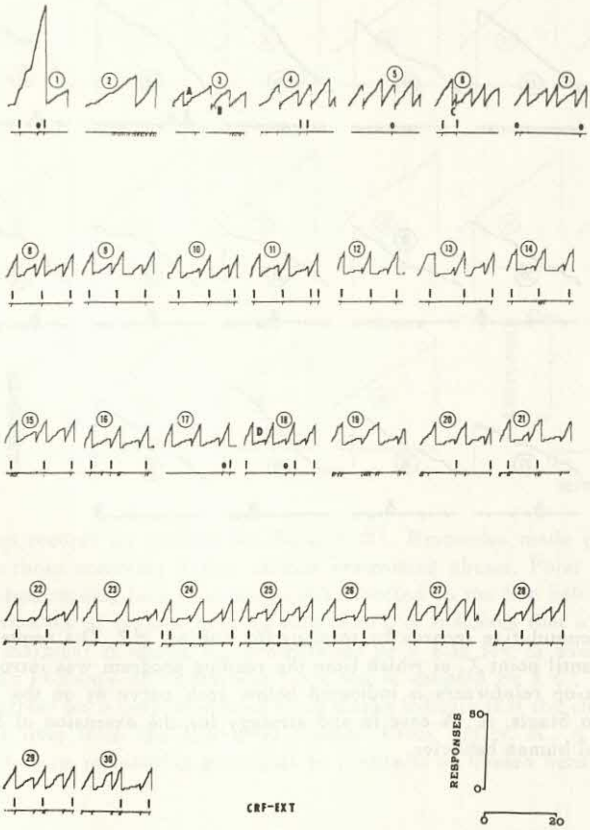


FIG. 6. The thirty daily session records for the multiple continuous reinforcement-extinction (*mult* CRF-EXT) subject show the reading response rates for the various experimental conditions. Responses prior to point *A* occurred during the pretraining phases of the study. At this point the reading program was introduced under CRF. Beginning with Session 4 each 20-minute reading session commenced with a CRF component which then alternated with EXT conditions. The event marker on the line below each record indicates the delivery of a back-up reinforcer: *1* notes the exchange of 10 marbles for a $.10 toy, *o* notes the presentation of a $.35 toy in exchange for 35 marbles, and unlettered event marks indicate the exchange of 1 marble for an item from the Universal Feeder. From Staats, A., A case in and strategy for the extension of learning principles to problems of human behavior.

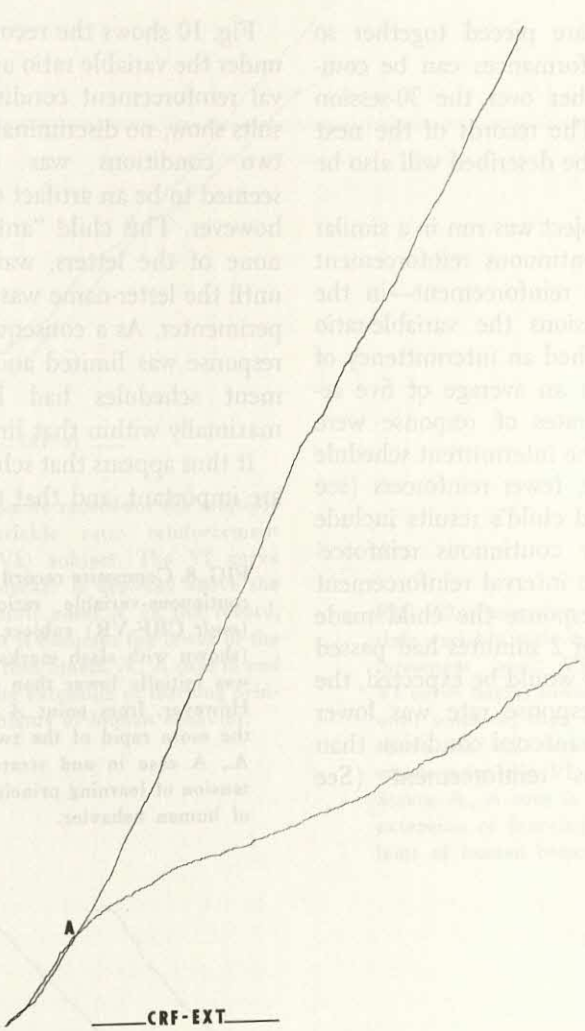


FIG. 7. Composite record for the *mult* CRF-EXT subject. In order to make a comparison between an *S*'s response rates for the two experimental conditions the records for reinforcement schedules were separated and recombined to yield an individual curve for each condition according to daily session sequence. All records commence with the introduction of the reading program. The composite records for the four *S*s are directly comparable; however, the size of each record is determined by *S*'s response rate. Fig. 7 shows that for the *mult* CRF-EXT *S* the EXT rate was initially the higher rate, but at point *A* it declined and crossed the CRF curve. The CRF response rate was relatively rapid and stable throughout the experiment. From Staats, A., A case in and strategy for the extension of learning principles to problems of human behavior.

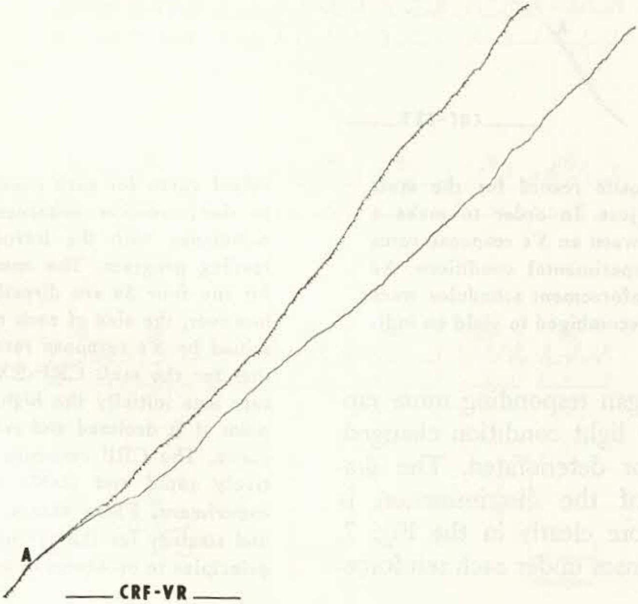
immediately began responding more rapidly. When the light condition changed, reading behavior deteriorated. The dramatic nature of the discrimination is shown even more clearly in the Fig. 7, where the responses under each reinforcement condition are pieced together so that the two performances can be compared to each other over the 30-session training period. The records of the next three children to be described will also be of this latter type.

The second subject was run in a similar manner under continuous reinforcement and variable-ratio reinforcement—in the final training sessions the variable-ratio schedule had reached an intermittency of one reinforcer for an average of five responses. Higher rates of response were produced under the intermittent schedule —using, of course, fewer reinforcers (see Fig. 8). The third child's results include responding under continuous reinforcement and variable interval reinforcement where the first response the child made after an average of 2 minutes had passed was reinforced. As would be expected, the child's reading response rate was lower under the variable-interval condition than under continuous reinforcement (See Fig. 9).

Fig. 10 shows the record of a child run under the variable ratio and variable interval reinforcement conditions. As the results show, no discrimination between the two conditions was exhibited. This seemed to be an artifact of the procedure, however. This child "anticipated" almost none of the letters, waiting 10 seconds until the letter-name was given by the experimenter. As a consequence, his rate of response was limited and both reinforcement schedules had him performing maximally within that limitation.

It thus appears that scheduling variables are important, and that the response rate

FIG. 8. Composite record for the multiple continuous-variable ratio reinforcement (*mult* CRF-VR) subject. The VR curve (shown with slash marks on the record) was initially lower than the CRF curve. However, from point *A* the VR rate is the more rapid of the two. From Staats, A., A case in and strategy for the extension of learning principles to problems of human behavior.



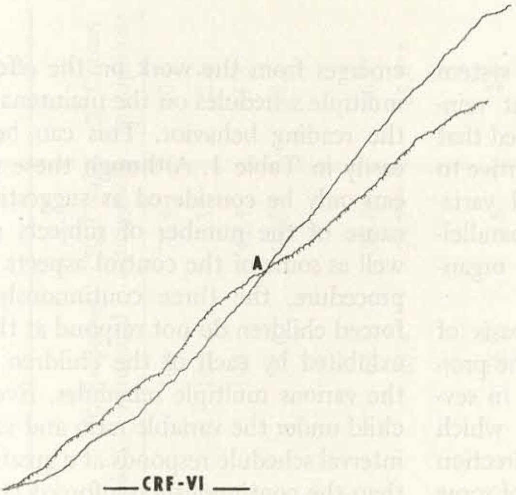


FIG. 9. Composite record for the multiple continuous-variable ratio reinforcement (*mult* CRF-VI) subject. The VI curve (with slash marks) is depicted above the CRF curve until point *A* on the record, at which point it becomes the lower of the two curves. From Staats, A., A case in and strategy for the extension of learning principles to problems of human behavior.

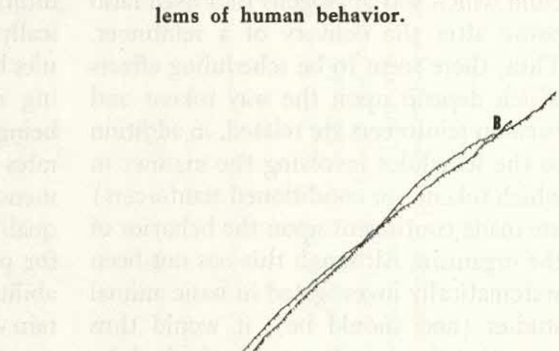


FIG. 10. Composite record for the multiple variable ratio-variable interval reinforcement (*mult* VR-VI) subject. The VI curve begins lower than the VR curve until point *A*, then crosses and remains above the VR curve until point *B*, at which point the VI rate declines. From Staats, A., A case in and strategy for the extension of learning principles to problems of human behavior.

and the efficacy of the reinforcer system may be increased by intermittent reinforcement. The results also indicated that the experimental situation was sensitive to the manipulation of experimental variables, producing results generally paralleling those found with sub-human organisms and more simple responses.

At the present time, on the basis of what has already been found by the project, I plan to extend the research in several different directions—some of which are already well underway. One direction concerns the further investigation of some basic variables whose importance has been suggested in the progress of the experimental analysis of reading. For example, our procedure uses a token system. The responses of the child are reinforced with marbles, which may be exchanged for various back-up reinforcers. In our early procedure the tokens were backed up by the reinforcers on a 1-to-24 basis. We noticed at that time that this had an effect upon the reading behavior of the child which was analogous to a fixed-ratio pause after the delivery of a reinforcer. Thus, there seem to be scheduling effects which depend upon the way tokens and back-up reinforcers are related, in addition to the schedules involving the manner in which tokens (or conditioned reinforcers) are made contingent upon the behavior of the organism. Although this has not been systematically investigated in basic animal studies (and should be), it would thus seem that there are two types of schedules which combine to produce effects upon the organisms rate of response. Ultimately, we would like to study the effect on reading performance of the "schedule" by which our tokens are backed up by the other reinforcers.

Another suggestion for basic research that we have from our experiments emerges from the work on the effects of multiple schedules on the maintenance of the reading behavior. This can be seen easily in Table 1. Although these results can only be considered as suggestive because of the number of subjects run as well as some of the control aspects of the procedure, the three continuously reinforced children do not respond at the rate exhibited by each of the children under the various multiple schedules. Even the child under the variable ratio and variable interval schedule responds at a greater rate than the continuously reinforced children —and with far less reinforcement, one token for 3.72 responses versus one for each response. In addition, there is considerable variance between the rates of the various children under the several multiple schedules (see Table 1), an average of 58.8 for the CRF-EXT child, 53.6 for the CRF-VR child, 44.8 for the CRF-VI child, and 42.4 for the VR-VI child. This suggests that the rates of response per reinforcer produced under different multiple schedules should be systematically studied. Previously multiple schedules have been used as a method for studying individual components—rather than being studied themselves for the over-all rates which they produce. We have commenced pilot work to study the relative qualities of different multiple schedules for practical learning situations, i.e., the ability of the multiple schedule to maintain vigorous behavior with little reinforcement.

These two avenues of research are cited since it is rather interesting that these indications for basic study have emerged in the process of studying a complex human behavior.

Another direction of research concerns the implications of our use of experimental designs in long-term studies of

TABLE 1

	SESSIONS								
Subject	Whole days on reading	Total for computations	Total responses	Average responses/session	Average tokens/session	Average responses/token	% Responses reinforced	% Total anticipations	% Correct anticipations
CRF #1	4–11	8	294	36.7	36.7	1.00	100	76.4	40.5
CRF #2	3–40	38	1473	38.7	38.7	1.00	100	2.3	2.1
CRF #3	3–40	38	1305	34.5	34.5	1.00	100	47.4	45.3
CRF-EXT	4–30 less Session 23	26	1530	58.8	44.5	1.32	75.6	94.0	30.1
CRF-VR	5–30	26	1394	53.6	34.5	1.56	64.3	50.0*	46.9*
CRF-VI	4–30 less Sessions 17–19	24	1075	44.8	29.3	1.53	65.4	75.7**	25.0**
VR-VI	4–30 less Sessions 6–7	25	1060	42.4	11.4	3.72	26.9	3.6	2.8

* Session 26 omitted.

** Sessions 3–16 only.

Table 1. Results of seven subjects run in this laboratory facility. Subjects CRF #1, #2, and #3 were administered only continuous reinforcement conditions (see Staats, Minke, Finley, Wolf and Brooks, in press), while the other four Ss were each presented two schedules of reinforcement in a multiple schedule design (see Staats, Finley, Minke and Wolf, 1963). Computations are based on full-length reading sessions; sessions omitted include pretraining phases, major deviations from normal procedure, or sessions for which complete data were unavailable. From Staats, A case in and strategy for the extension of learning principles to problems of human behavior.

children engaged in complex learning. Because of the complexity of the learning, behaviors such as reading cannot be assessed in short-term group studies. Reliable results were obtained over a lengthy period, however, using the multiple schedule design where two conditions were presented to the same child. This design can be applied to the assessment of other independent variables besides those of reinforcement schedules. The different effects of reading materials could also be assessed. That is, using the multiple schedule design we will be able to present the same child with two different types of reading program and record the child's rate of learning under each condition. Thus, as a gross example, whole-word presentation could be compared to phonetic presentation in conditions of good laboratory control. This type of investigation should yield a deeper understanding of reading acquisition.

Another line of research in which I will move is in the application of the procedures and principles to the study of learning in special populations of children. We hope soon to have some experiments going with mental retardates—first, just to see how the procedures transfer to this new population, and later, perhaps, to establish some of the learning differences between retardates and normals in this significant type of human learning. The methods could also be used with other special problems of children, e.g., deaf children, autistic children, and so on.

Lastly, I have been extending the research to the solution of some of the problems involved in actually teaching reading. I'm not prepared at this moment to present the results in detail, but I have already taught one child the rudiments of reading at the age of three years and two months (and the procedures are now being extended to other children). This child has a reading repertoire of almost all the lower case and capital letters as well as thirty-two words (including the variants of one word, e.g., *drives* and *drive* are counted as two words). This child (our daughter) reads the words alone and in sentences and short paragraphs. The following is a sample paragraph:

> Jenni drives to a zoo.
> Jenni plays at the zoo with a girl.
> Jenni and the girl eat at the zoo.

In conclusion, although I am not suggesting that this is the ultimate in the research which is necessary, I feel fairly confident of the productiveness of this systematic analysis. Based upon the findings so far, it would seem that a procedure and program will eventuate which will make more expeditious the original training of reading in young children.

Referring again to the general strategy suggested for the application of learning principles to significant human behaviors, the research project on reading has thus made the following progress. It commenced with at least a partial behavioral analysis of reading and of some of the learning factors which contribute to the difficulty of training. Then several demonstrational studies were conducted which showed that the relevant principles of reinforcement and discrimination did indeed apply to the acquisition of reading. Following this, a laboratory procedure and apparatus were constructed within which the systematic study of reading could take place. This facility has been tested in studies which more systematically assess reinforcement variables within the context of reading. This progress has suggested additional plans for continued systematic analysis of reading. In addition, as I have briefly described, I have been working with the further application of the findings to the actual problem of training children to read, and should soon have systematic results to report. This last development constitutes entrance into the final stage of the strategy proposed in the introduction.

I will now leave the field of reading *per se* and explore the implications of the reading project for other types of problems of human behavior. To begin with, we might ask where we stand with a behavioristic approach to the problems of human behavior. We do possess a fine set of principles and procedures established in basic studies, primarily with lower animals. The heavyweight empirical principles have been well substantiated a number of times. Many of these heavyweight principles have been extended to human behavior, also in basic studies. The principle of respondent conditioning has been shown to be involved in conditioning fears (Watson and Rayner, 1920), attitudes (Staats and Staats, 1958), and semantic properties of language (Osgood, 1953; Mowrer, 1954; Cofer and Foley, 1942; Staats, 1961). The principle of reinforcement has been shown to operate with verbal classes (see Krasner, 1958; Salzinger, 1959), problem solving (Maltzman, 1955; Adamson, 1959), social behavior (Azrin and Lindsley, 1956; Bandura, 1962), attitudes (Scott, 1957), the learning of mental retardates (Orlando and Bijou, 1960), personality indices (Nuthmann, 1957; Staats, Staats, Heard, and Finley, 1962), as well as various types of abnormal behaviors (Ferster, 1961; Ayllon and Michael, 1959).

Because of the verification of learning principles in these new domains of behavior, we have confidence in the relevance of our principles and procedures and in their eventual ability to solve complex human problems of behavior. But we do not have at this time a large number of analyses of different behavior problems, as well as long-term projects involving systematic and applied studies of behavior problems. We do not, consequently, at this time have a set of procedures for treatment to transmit to practitioners. Perhaps I can give some examples of what I mean. Several years ago Rheingold, Gewirtz, and Ross (1959) conducted a study in which it was shown that the vocal behavior of three-month-old infants could be strengthened through response-contingent reinforcement. This is an important demonstrational study. But it also suggests that the original acquisition of speech in infants should be systematically studied. If in a few 30-minute periods the vocal behavior of infants can be strengthened, then systematic application of reinforcers over a long period of time should result in a more rapid acquisition of speech than would otherwise occur. Study of this process with systematic observation and recording should help us understand the process and lead to procedures which are valuable for producing desirable development of speech behavior. There is no doubt that a primary problem of some children is their "backward" development of speech. Autistic children are notable in this respect, and it is no doubt the case that many children called mental retardates are victims of poor training histories in this important area.

There are no special obstacles to this type of study. There are many institutionalized children who could only profit from the procedures involved in attempting to shape good verbal behavior in them. Many autistic, brain damaged, mentally retarded children would serve as fine subjects in procedures which would surely improve the child's adjustment and yield procedures that could be generally applied.

As another example, Ayllon and associates (Ayllon and Haughton, 1962; Ayllon and Michael, 1959) have shown that operant conditioning principles can be applied to behavior problems in psychotics. This research has also indicated that tokens backed up by food can be used as an effective reinforcer system in working with psychotics. The next step could be the use of the principles and procedures to shape adjustive behaviors in psychotics. Isaacs, Thomas, and Goldiamond (1960) have shown that mute schizophrenics could be operantly shaped to speak again, using only very lightweight reinforcers and in what constituted a relatively short experimental procedure. With these demonstrations and the use of a reinforcer system like that of Ayllon and Haughton (1962), it should be possible to shape adjustive behavior in psychotics of a much more extensive type. For example, the work behaviors of psychotics should be studied in *long-term systematic projects*. Such study should also be applied to other adjustive social behaviors, language behaviors, and so on —any behavior in which the psychotic is deficient and which could be shaped through the manipulation of reinforcement variables.

Again, the back wards of neuropsychiatric hospitals are full of patients who could only profit from such treatment-research activities. Systematic attempts to shape the behavior through reinforcement should yield a general understanding of the behavior and also general programs and procedures for the treatment of other patients.

Returning again to autistic children, Ferster and associates (1961) have indicated that the behavior of these children is subject to reinforcement principles. This constitutes a demonstrational study in that the behaviors under study were relatively simple, e.g., bar-pressing. The behavior problems of children should generally be approached using behavioral methods, since many such problems involve learning. Actually, these applications are accruing. Several years ago Williams (1959) showed that temper tantrums could be treated by extinction procedures. More recently this has been extended by Wolf, Mees, and Risley (1963) with a child diagnosed variously as mentally retarded, schizophrenic, and brain-damaged. Several different behaviors were modified in this child by means of learning treatments, resulting in marked improvement in the child's adjustment.

These studies may be considered to have moved past the demonstrational stage and into the application of learning principles to the solution of behavior problems of some importance. This successful treatment should be extended to a systematic study of various complex behavior problems in children.

One of the areas in which the application of learning principles has appeared to me to be needed is in the field of rehabilitation. My discussions with therapists in this field have suggested that much of their work, especially with children, involves training new behaviors under circumstances in which the reinforcers are weak. For example, *prior* to developing skill with a prosthesis, the child secures reinforcement more easily for various already learned substitution movements. Thus, some way must be found at first to supply "extrinsic" reinforcement for the more difficult "prosthetic responses," since in a competitive sense these responses are not themselves "naturally" reinforcing. Research being conducted by our students at Arizona State University has begun to apply reinforcement principles to such problems of training and to many others. For example, two students[2] have been working with a boy whose left arm was paralyzed through brain-damage and who has not responded to rehabilitation efforts since right arm movements serve as a substitute. The plan has been to reinforce the boy for left arm movements directed toward a large visual target. As these left arm movements have been strengthened sufficiently, the target has been reduced in size until the accuracy of the arm movements improved. So far the treatment has met with success using social reinforcers backed up by toys.

Following this demonstration it has also been possible to achieve startling improvements in motor performance through the use of a token reinforcer system such as has been described herein.[3] When reinforcement was made available for a child who refused to walk alone, the desired behavior was obtained readily. The same was true of a child who rehabilitation specialists had been trying to train to fall down properly. This immediate improvement coincides with my own previous observations of some remedial reading cases with whom we began work in the process of the experimental analysis of reading. Although they were diagnosed as remedial readers by school tests, when we introduced response-contingent reinforcement, we obtained remarkable improvement—too remarkable to be considered acquisition curves. The conclusion is that many problems appear to be more of a reinforcement problem—called motivational problems in common sense terms. This means that the development of an appropriate reinforcer system and a method for its application according to learning principles may be the most important step in solution of the problem. At any rate, we need long-range, systematic studies of sensory-motor training procedures emphasizing the development and application of reinforcement procedures (see Meyerson, Michael, Mowrer, Osgood, and Staats, 1963, for a supplementary discussion of the use of extrinsic reinforcers in the field of rehabilitation).

Another problem which can be considered similar to those of rehabilitation involves the problem of stuttering which was dealt with in a previous lecture in this series by Goldiamond (1963). His work in this area may be considered to be a systematic application of certain principles of reinforcement to the study of this type of behavior. In general, the principles seem to hold well and this suggests that the behavior is acquired, at least in part, according to reinforcement principles. The next step is to work with actual problems of stuttering in an attempt to beneficially modify the behavior of stuttering and produce procedures and principles which have general applicability.

Thus, at this time I think we need to multiply the investigators who have chosen a type of behavior and set about the experimental analysis of the behavior in long-term projects. We have the basic principles of learning and a number of experimental procedures for applying the principles to the problems of individuals. But the fact remains that we need many more experimental analyses of behavior problems which are carried as far as they can go in the solution of complex human behavior problems. With reference to these needs, I'd like to describe more fully the previously mentioned four steps which seem to be involved in such long-term studies.

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[2] Karl A. Minke and William G. Heard

[3] Edward M. Hanley and Albert E. Neal

To begin the extension of basic learning principles to a complex human behavior, it seems necessary to make a learning analysis of the behavior involved. This analysis can be of several types. One way is to begin with systematic observations of the behavior. This might be elaborated to include observations of the reinforcers which are acting upon the behavior, as well as deprivation and satiation operations which affect the reinforcers, and also the way the reinforcers become reinforcing, if conditioned reinforcers are involved. The discriminative stimuli which have come to control the behavior may be important. This may include various types of stimuli—environmental, response-produced, interoceptive, and so on. The behavior in which one is interested may actually be a complex chain itself—not a single, momentary response. The observations should include reference to competing behaviors. As both Lindsley (1956) and Ferster (1961) have shown, whether or not psychotic episodes occur, for example, is a function not only of the strength of the psychotic behavior itself, but also of competing behaviors.

But the learning analysis may not start with such systematic observations. Although this may be alien to some contemporary investigators, analysis may first be of a more theoretical nature, involving tentative extensions of learning principles prior to obtaining further observations. It was interesting to me in skimming the tapes of a few of the previous lectures that in two cases there were vigorous denials of any interest in theory—yet Skinner's theoretical analysis of human behavior, especially verbal behavior, in the absence of any experimental substantiation, was the basis of their own work. It should be pointed out that any extension of a learning principle to a new domain of behavior is *theoretical* until corroborated, and can quite legitimately be called an hypothesis.

The fact is that this type of analysis is important, and in many cases precedes even systematic, naturalistic observation. It is only a misconception of what constitutes theory in psychology which leads to the general rejection of analysis before experimentation or, as Skinner calls his *Verbal Behavior*, "exercises in interpretation." Tentative guesses concerning the types of learning variables which may have accounted for a behavior are more than empty gestures. They suggest procedures which when applied can verify the guess, or eliminate it as a possibility. Untestable concepts such as those which abound in dynamic approaches may not offer this advantage—but guesses in terms of empirical principles suggest empirical applications.

Whether the analysis is based upon systematic observations or whether the analysis is more what we usually call theory, the next step in the extension of learning principles many times appropriately involves a "demonstrational" study. This means testing some of the main principles of the analysis in the context of the behavior of interest. For example, is reinforcement important in the acquisition and maintenance of the behavior involved. In demonstrational studies one may choose to use group designs and statistical analyses in short-term experiments. The most expeditious way to verify the basic principles in the new behavior domain may be advisable. In any event, I have found that in this type demonstrational study one begins to learn more about the behavior and subject population which is involved—and one may get ideas pertinent to more systematic study of the behavior.

The next step is to make a more systematic attempt to explore the principles involved in the acquisition, maintenance, or change in the behavior under study. Additional variables may be tested at this time —reinforcement schedules, discriminative stimulus control, or what have you. The studies of Bijou and associates (e.g., Bijou and Oblinger, 1960; Bijou and Orlando, 1961) with the operant conditioning of mental retardates may be considered as an example here. At this stage of the long-term study of a behavior problem, the attempt may be made to achieve better experimental control perhaps through the development of improved procedures or apparatus. If the behavior under study is complex, as most significant human behaviors are, it can be expected that short-term group studies will not suffice. Procedures will have to be worked out in which the behavior can be studied over a long period of time. We have to distinguish the modification of what are actually relatively simple behaviors or classes of behavior from the modification of more complex behaviors. It is stimulating to us, and a momentous step, to extinguish temper tantrums, or shape walking versus crawling, or shape going to bed at night without a fuss, or the striking of a target in a previously useless arm. But we have to realize what the nature of this progress in learning extensions is, as well as the task that lies ahead. These are impressive demonstrations of the relevance and applicability of learning principles to the treatment of behavior problems. However, we can't expect to restore the "word salad" of the schizophrenic to high level communication and good language behavior in reasoning through a short-term procedure. There are many behaviors—the original acquisition of speech, the acquisition of reading, the development of complex social behaviors, work behaviors, so-called mental retardation, etc.—which are acquired (or are not acquired) only over a period of many years. We must expect that it will take years to change or institute those behaviors even under good training procedures.

Nevertheless, we must begin the study of such complex human behaviors—as well as the more simple ones. But a belief that the operant shaping of a simple behavior in a short time indicates that all behaviors will fall into place this way, or that the major problems have been solved, is unrealistic. Although it would be expected on the basis of our findings that the principles hold from rat to man, the repertoire to be acquired by man is fantastically complex. The task of establishing programs of training with which to deal with problems of complex human behavior lies largely ahead.

So, the learning approach appears to be tremendously productive—but there is much to do. Which brings us to the final step in the extension of learning to the solution of practical problems of behavior. Based upon my research in the acquisition of reading, I would conclude that when one works over a period of years with the same problem of training behavior, first in demonstrational studies, then in other systematic studies, he learns a great deal about what can be done about some of the problems involved in modifying the behavior in a benign way. With this experience he is better prepared to begin research on actual practical problems. I had, for example, prior to actually training a child to read, very well worked out schemes for the procedure to be used, based upon my past research.

For solving actual problems, however, the simple knowledge of basic learning principles will not provide adequate background. Many learning theorists occupied solely with basic problems will confess quite frankly that they would not have the foggiest notion of how to help solve human problems involving learning, e.g., how to train a child to read. I think the preceding steps I've outlined, on the other hand, will provide knowledge for approaching practical problems of behavior in quest of general solutions.

My experience suggests, then, that it is important for investigators to become interested in the systematic and detailed study of a type of behavior and continue with the study over a long period of time, extending their progress as far as they can go towards the solution of the practical problems involved. A great deal of knowledge can be gained in the practical situation where one attempts to modify behavior—even if the situation does not involve precise laboratory control. This is a point worth stressing, for there are many experimental psychologists of a learning orientation who are really opposed to the applied extension of learning principles. Among them are methodological "purists" who feel that if you cannot achieve precise experimental control you should not tackle a problem. There is also in some circles a denigration of applied research versus basic or "pure" science. Actually, however, the full status of a science is achieved when it aids in the solution of practical problems, improving over common sense notions. The application of learning principles and methods to practical problems is an important way of advancing the science of behavior. I feel these applications of principles previously found in the basic science constitute one of the most important types of problems in which a behavioral psychologist can be involved.

In this process one can expect that the first efforts will not be done with laboratory precision. To expect this would be to place too difficult a standard for the activity. Successive approximations to precision must be expected. The first development of a procedure may be relatively gross, but these early steps must be taken to gain further knowledge on which to make improvements.

This raises some questions about the assessment of one's results. If the training requires long-term procedures this means single organism research. What means can be used to assess results? One way is the one we used in the context of reading in which the same child was put under two experimental conditions and the behaviors produced under each could be compared. In long-term studies it was possible to produce reliable results.

Another way is to consider the patient's previous history of behavior as the baseline—as the control period. Then when learning conditions are instituted the improved behavior which results may be compared to the pre-treatment behavior. Wolf, Mees, and Risley used this method. They plotted the child's behavior of wearing glasses after instituting reinforcement procedures—when previously the child could not be made to wear glasses. The work of Isaacs, Thomas, and Goldiamond in which the speech of two long-standing mute schizophrenics was restored by operant procedures is another example.

In conclusion, the methods and principles of learning seem to offer the possibility for dealing with disorders of behavior in a more profound manner than is otherwise currently available. However, it is suggested that great advancements still lie ahead in the application of learning methods and principles to behavior problems. In this task, because the general method of a learning psychotherapy is based upon the manipulation of observable independent and dependent variables, the method should have advantages characteristic of other applied sciences—one of which is their "self-corrective" nature. That is, when working with observable events, it is evident when something has been accomplished and when it has not, where principles hold and where they do not, where development is still necessary, and so forth. Since learning approaches to behavior modification are based upon a set of experimentally established principles, a development consistent with that occurring in other applied sciences can be confidently predicted.

REFERENCES

Adamson, R. Inhibitory set in problem solving as related to reinforcement learning. *J. exp. Psychol.*, 1959, **58,** 280–282.

Ayllon, T. and Haughton, E. Control of the behavior of schizophrenic patients by food. *J. exp. anal. Behav.*, 1962, **5,** 343–352.

Ayllon, T. and Michael, J. The psychiatric nurse as a behavioral engineer. *J. exp. anal. Behav.*, 1959, **2,** 323–334.

Azrin, N. H. and Lindsley, O. R. The reinforcement of cooperation between children. *J. abnorm. soc. Psychol.*, 1956, **52,** 100–102.

Bandura, A. Social learning through imitation. *Nebraska Symposium on Motivation*, 1962.

Bijou, S. W. and Oblinger, B. Responses of normal and retarded children as a function of the experimental situation. *Psychol. Rep.*, 1960, **6,** 447–454.

Bijou, S. W. and Orlando, R. Rapid development of multiple-schedule performances with retarded children. *J. exp. anal. Behav.*, 1961, **4,** 7–16.

Cofer, C. N. and Foley, J. P. Mediated generalization and the interpretation of verbal behavior: I. Prologemena. *Psychol. Rev.*, 1942, **49,** 513–540.

Ferster, C. B. Positive reinforcement and behavioral deficits of autistic children. *Child Develpm.*, 1961, **32,** 437–456.

Ferster, C. B. and Skinner, B. F. *Schedules of reinforcement*. New York: Appleton-Century-Crofts, Inc., 1957.

Goldiamond, I. Maintenance of ongoing fluent verbal behavior and stuttering. Lecture delivered at Stanford University, Palo Alto, Calif., January 1963.

Isaacs, W., Thomas, J., and Goldiamond, I. Application of operant conditioning to reinstate verbal behavior in psychotics. *J. speech hearing Disorders*, 1960, **25,** 8–12.

Krasner, L. Studies of the conditioning of verbal behavior. *Psychol. Bull.*, 1958, **55,** 148–170.

Lindsley, O. R. Operant conditioning methods applied to research in chronic schizophrenia. *Psychiat. Res. Rep.*, 1956, **5,** 140–153.

Long, E. R., Hammack, J. T., May, F., and Campbell, B. J. Intermittent reinforcement of operant behavior in children. *J. exp. anal. Behav.*, 1958, **1,** 315–339.

Maltzman, I. Thinking: From a behavioristic point of view. *Psychol. Rev.*, 1955, **62,** 275–286.

Meyerson, L., Michael, J. L., Mowrer, O. H., Osgood, C. E., and Staats, A. W. Learning, behavior, and rehabilitation. In L. H. Lofquist (ed.), *Psychological research and rehabilitation*. Washington, D.C.: American Psychological Association, 1963.

Mowrer, O. H. The psychologist looks at language. *Amer. Psychol.*, 1954, **9,** 660–694.

Nuthmann, A. M. Conditioning of a response class on a personality test. *J. abnorm. soc. Psychol.*, 1957, **54,** 19–23.

Orlando, R. and Bijou, S. W. Single and multiple schedules of reinforcement in developmentally retarded children. *J. exp. anal. Behav.*, 1960, **3,** 339–348.

Osgood, C. E. *Method and theory in experimental psychology*. New York: Oxford University Press, 1953.

Rheingold, H. L., Gewirtz, J. L., and Ross, H. W. Social conditioning of vocalizations in the infant. *J. comp. physiol. Psychol.*, 1959, **52,** 68–73.

Salzinger, K. Experimental manipulation of verbal bevavior: A review. *J. gen. Psychol.*, 1959, **61,** 65–94.

Scott, W. A. Attitude change through reward of verbal behavior. *J. abnorm. soc. Psychol.*, 1957, **55,** 72–75.

Skinner, B. F. *Verbal behavior*. New York: Appleton-Century-Crofts, Inc., 1957.

Staats, A. W. Verbal habit-families, concepts, and the operant conditioning of word classes. *Psychol. Rev.*, 1961, **68,** 190–204.

Staats, A. W., Finley, J. R., Minke, K. A., and Wolf, M. Reinforcement variables in the control of unit reading responses. *J. exp. anal. Behav.*, 1964, **7,** 139–149.

Staats, A. W., Minke, K. A., Finley, J. R., Wolf, M., and Brooks, L. O. A reinforcer system and experimental procedure for the laboratory study of reading acquisition. *Child Develpm.*, 1964, **35,** 209–231.

Staats, A. W. and Staats, C. K. Attitudes established by classical conditioning. *J. abnorm. soc. Psychol.*, 1958, **57,** 37–40.

Staats, A. W. and Staats, C. K. A comparison of the development of speech and reading behavior with implications for research. *Child Develpm.*, 1962, **33,** 831–846.

Staats, A. W., Staats, C. K., Heard, W. G., and Finley, J. R. Operant conditioniong of factor analytic personality traits. *J. gen. Psychol.*, 1962, **66,** 101–114.

Staats, A. W., Staats, C. K., Schutz, R. E., and Wolf, M. The conditioning of textual responses using "extrinsic" reinforcers. *J. exp. anal. Behav.*, 1962, **5,** 33–40.

Watson, J. B., and Rayner, R. Conditioned emotional reactions. *J. exp. Psychol.*, 1920, **3,** 1–14.

Williams, C. D. The elimination of tantrum behavior by extinction procedures. *J. abnorm. soc. Psychol.*, 1959, **59,** 269.

Wolf, M., Mees, M., and Risley, T. Application of operant conditioning procedures to the behavior problems of an autistic child. Paper delivered at the Western Psychological Association Convention, Santa Monica, Calif., April 1963.

chapter IV

Communication and Other Functions of Language

THE PREVIOUS CHAPTER dealt with the extension of conditioning principles to the study of language behavior deriving from a Skinnerian analysis in terms of operant conditioning principles. Another major learning approach to the study of language has its roots in the work of Clark L. Hull (for example, selection 21) as it has been extended by such individuals as C. N. Cofer and J. P. Foley, (for example, selection 22) J. Dollard and N. E. Miller (1950), C. E. Osgood (1953), O. H. Mowrer (1960) and Staats (1961). This chapter attempts to present a selection which will indicate some of the contributions which this latter approach makes to understanding language behavior—and also to lay a foundation for some of the extensions which occur in later sections. In addition, although this approach involves to a larger extent the principles of classical or respondent conditioning, an attempt will be made to show how an integration of various learning orientations provides a more powerful approach to the understanding of language learning and function.

The first article to be presented is an excerpt from a classic by Hull which begins an S-R analysis of the manner in which chains of responses may mediate complex adjustive behaviors. He describes how such chains (which could be "symbolic," or verbal) can occur prior to environmental events and in that way "anticipate" consequences. In this analysis, the concept of *pure stimulus act* is also introduced. The total formulation may be considered to be the basis for conceptions of (and resulting experiments on) implicit responses which produce stimuli which mediate, or control, other responses. Examples occur in analyses of word meaning, sensory-preconditioning, attitudes, problem solving, semantic generalization, and so on. Some of these topics will be discussed in later articles which are presented.

The next selection, an excerpt from a paper by Cofer and Foley, summarizes a number of studies, and makes an explicit analysis of the manner in which responses may mediate "similarity" between stimuli which actually differ on a physical stimulus dimension. Thus, if two stimuli which are physically dissimilar come through conditioning to elicit the same response (and its attendant stimulus properties), experience with only one of the stimuli will generalize to the other. Cofer and Foley describe this ability to mediate generalization as one of the important functions of language behavior. Further elaboration of this function will occur in later papers.

Phillips' study is a sophisticated verification and extension of these principles of semantic generalization. Other studies have used natural synonyms with which to test the expectations that meaning is a response and, consequently, that when two words have the same meaning, experience with one will generalize to the other. Phillips, instead of depending upon natural synonyms, actually develops word synonyms in the laboratory by conditioning similar responses to the words.

Osgood has developed a general theory of learning which is congruent with these concepts and experimental results and explicitly discusses how word meaning may be considered in terms of learning principles. Although the excerpt by Osgood is short, it sets forth what has in contemporary psychology become a powerful approach to language.

Mowrer takes the theory and the empirical developments of semantic generalization and extends the principles into a consideration of the actual act of communication—the manner in which past S-R processes may function in producing new learning, solely on the basis of language. He describes the basic act of communication as classical conditioning of the meaning response elicited by the predicate word (or words) in a sentence to the subject word, as well as to the meaning response elicited by the subject word. Many new implications concerning important personal and interpersonal functions of language are thereby suggested.

The next article, by the present author, indicates that acts that are commonly called communication include additional principles of learning not suggested in the preceding article. Mowrer's analysis could be said to derive from a Hullian theoretical framework. On the other hand, the operant conditioning approach to language seems also to offer principles which are important to verbal communication. Several types of operant conditioning verbal mechanisms are described, and how these mechanisms can function in controlling appropriate behavior as well as in producing new learning is discussed. It is also suggested that an integration of S-R principles, methods, and findings forms a more powerful approach than the separatist tendencies promoted by different "theoretical" positions. The productivity of an integrated S-R approach will be suggested again later in this chapter as well as in some of the chapters that follow.

The area of verbal learning which has used the methods of paired associate and serial learning has contributed a vast experimental literature. For the most part, however, the methods of experimentation have been used in basic research in the attempt to find basic, analytic principles of learning. It is suggested that a necessary and important future development of the field of verbal learning will be the *application* of its methods to the study of relevant facets of language development and function, in addition to the study of basic principles.

Skinner (1957) has suggested that important aspects of language involve intraverbal responses or word associations (although he did not indicate the relationship of his discussions to the experimentation on word associations). The present author (Staats and Staats, 1963) has also discussed the importance of word response sequences in areas such as intelligence development, grammatical verbal construction, problem solving, and scientific and social reasoning. It is suggested that the apparatus and procedures of paired associate and serial learning seem ideally suited for the study of such problems of complex language behavior.

It is primarily for this reason that the next study of Russell and Storms is a classic. It begins to experimentally study the *function* of word associations. In addition, the study also deals with the important concept of the implicit mediating response—in this case, an implicit word response. The results indicate that word responses under the control of other word responses (or the stimuli they produce) may be implicit and yet mediate other responses that they control. This study can be considered a paradigm for some types of implicit thinking.

Thus far, in Chapters III and IV, several different approaches to language have been represented in the selections, for example, operant conditioning, mediating responses, and word associations. As previously mentioned, the findings of these different orientations have tended to remain strictly separate. However, the principles and methods of operant conditioning studies of verbal responses, those of semantic generalization and semantic conditioning studies, and those of word association studies, when combined, appear to offer a stronger experimentally based learning approach to language. The possibility of this type of integration of research and theory is further suggested in the next two articles in this section. The first article summarizes a conception of conditioned reinforcement in terms of respondent conditioning principles. With this as the basic theory, it is possible to integrate the concepts and experimental findings of studies of word meaning stemming from a Hullian framework with the concepts of operant conditioned reinforcement as it is related to language acquisition and function. This integration has implications for areas yet to be presented in the book, for example, attitude development and social interaction.

The last article also indicates the possibility of the integration of research and theory within the context of discussing the development and function of word classes as described in the introduction to Chapter III. In addition, another very important function of verbal behavior is discussed—the manner in which chains of verbal responses may mediate behavior which "anticipates" future events (that is, purpose). The verbal mechanism of word response chains will be important in understanding the section on problem solving and reasoning (Chapter IV).

14.

Knowledge and Purpose as Habit Mechanisms*

Clark L. Hull

It is only with the greatest difficulty that scientists are able to maintain a thoroughly naturalistic attitude toward the more complex forms of human behavior. Our intellectual atmosphere is still permeated in a thousand subtle ways with the belief in disembodied behavior functions or spirits. The situation is aggravated by the fact that the details of the more complex action patterns are so concealed as to be almost impossible of observation. Even so, the outlook is hopeful. The work of many ingenious investigators is bringing to light important details of the hidden processes, and enough evidence has already accumulated to enable us in a number of cases to discern with tolerable clearness the broad naturalistic outlines of their operation.

I

One of the oldest problems with which thoughtful persons have occupied themselves concerns the nature and origin of knowledge. How can one physical object become acquainted with the ways of another physical object and of the world in general? In approaching this problem from the point of view of habit, it is important to recognize that knowledge is mediated by several fairly distinct habit mechanisms. In the present study but one of these will be elaborated.

Let us assume a relatively isolated inorganic world sequence taking place as shown in Fig. 1. Here S_1, S_2, etc., represent typical phases of a sequential flux, the time intervals between successive *S*'s being uniform and no more than a few seconds each. Let us suppose, further, that in the neighborhood of this world sequence is a sensitive redintegrative organism. The latter is provided with distance receptors and is so conditioned at the outset as to respond characteristically to the several phases of the world sequence. Each S accordingly becomes a stimulus complex impinging simultaneously on numerous end organs. As a re-

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* From C. L. Hull, Knowledge and purpose as habit mechanisms, *Psychol. Rev.*, **37**, 511–525 (1930). Reprinted by permission of the American Psychological Association.

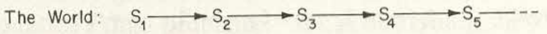


FIG. 1. From Hull: Knowledge and purpose as habit mechanisms.

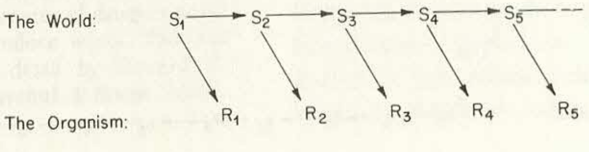
sult, each phase of the world sequence now becomes a cause, not only of the succeeding phase in its own proper series, but also of a functionally parallel event (reaction) within the neighboring organism. The organismic responses of the series thus formed have no direct causal relationship among themselves.[1] R_1 in itself has no power of causing (evoking) R_2. The causal relationship essential in the placing of R_2 after R_1 is that of the physical world obtaining in the S-sequence; R_2 follows R_1 because S_2 follows S_1. The situation is represented diagrammatically in Fig. 2.

Now a high-grade organism possesses internal receptors which are stimulated by its own movements. Accordingly each response (R) produces at once a characteristic stimulus complex and stimuli thus originated make up to a large extent the internal component of the organism's stimuli complexes. Let these internal stimulus components be represented by s's. If we assume, in the interest of simplicity of exposition, that the time intervals between the phases of the world flux selected for representation are exactly equal to those consumed by the $S \rightarrow R \rightarrow s$ sequences, the situation will be as shown in Fig. 3, S_2 coinciding in time with s_1, S_3 with s_2 and so on.

Now, by the principle of redintegration, all the components of a stimulus complex impinging upon the sensorium at or near the time that a response is evoked, tend themselves independently to acquire the capacity to evoke substantially the same response. We will let a dotted rectangle indicate that what is enclosed within it constitutes a redintegrative stimulus complex; and a dotted arrow, a newly acquired excitatory tendency. After one or more repetitions of the world sequence, the situation will be as shown in Fig. 4.

As a result of the joint operation of the several factors summarized in Fig. 4, the organismic reactions (R's) which at the outset were joined only by virtue of the energies operating in the outer world sequence of S's, are now possessed of a genuine dynamic relationship lying within

FIG. 2. From Hull: Knowledge and purpose as habit mechanisms.



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[1] This neglects the original dynamic influence of the ever-present internal component of the organismic stimulus complex into which each phase of the world sequence enters to evoke the corresponding organismic reaction. The excitatory potency of this internal component is here supposed to be minimal. Its influence is neglected in the interest of simplicity of exposition. Its undeniable presence clearly introduces an element of subjectivity into reactions which appear superficially to be evoked purely by the external world.

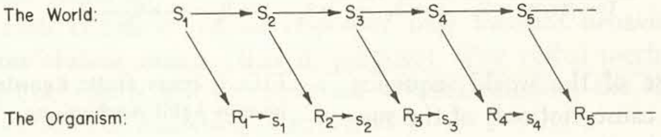

FIG. 3. From Hull: Knowledge and purpose as habit mechanisms.

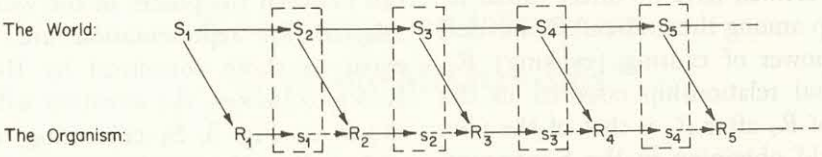

FIG. 4. From Hull: Knowledge and purpose as habit mechanisms.

the organism itself. To make this clear, let it be assumed that the world sequence begins in the presence of the organism, but is at once interrupted. The resulting situation is shown diagrammatically in Fig. 5. The newly acquired excitatory tendencies, unless interrupted by some more potent influence, should continue the organismic sequence of responses very much as when they were first called forth as the result of the stimulation by the world sequence.

In summary it may be said that through the operation of a variety of principles and circumstances, the world in a very important sense has stamped the pattern of its action upon a physical object. The imprint has been made in such a way that a functional parallel of this action segment of the physical world has become a part of the organism. Henceforth the organism will carry about continuously a kind of replica of this world segment. In this very intimate and biologically significant sense the organism may be said to know the world. No spiritual or supernatural forces need be assumed to understand the acquisition of this knowledge. The process is entirely a naturalistic one throughout.

II

Once the organism has acquired within its body this subjective parallel to the ways of the physical world, certain other activity patterns or habit mechanisms at once become operative. One of the more important of these is the power of fore-

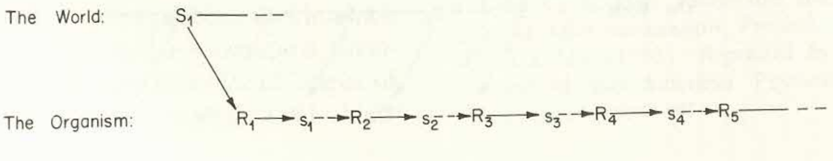

FIG. 5. From Hull: Knowledge and purpose as habit mechanisms.

sight or fore-knowledge. A great deal of mystery has surrounded this problem. Foresight may be defined for our present purpose as *the reaction to an event which may be impending, but which has not as yet taken place.* The difficulty seems largely to have been concerned with the problem of how an organism can react to an event not yet in existence. The reasoning runs: An event not yet in existence cannot be a stimulus; and how can an organism react to a stimulus which does not exist? In terms of our diagram, how can R_5, which is a reaction to the stimulating event S_5, take place before S_5 itself has occurred?

An important circumstance connected with foresight is the fact that the tempo of the acquired subjective parallel to the outer world sequence is not limited to that of the latter. Indeed, there is evidence indicating a tendency for a primary conditioned reaction to run off at a higher speed than that of the master world sequence which it parallels.[2] Thus it comes about that, even when both series begin at the same instant, the end-reaction of the subjective series may actually antedate the stimulus in the world sequence which exclusively evoked it previous to the conditioning shown in Fig. 4. It is evident that this possibility of the heightened tempo on the part of the organismic act sequence is intimately connected with the possession by the organism of knowledge of events before they actually take place.

The biological advantage of antecedent knowledge of impending events is great. This is particularly clear in the case of defense reactions. These latter fall into two main types—flight and attack. Let us suppose that in the example elaborated above, S_5 is a seriously nocuous stimulus and R_5 is a successful flight reaction. Foresight will result from the reeling off of the R-series faster than the S-series so that s_4 will evoke R_5 before S_5 has occurred. In this event S_5, when it does occur, will not impinge on the organism for the reason that the latter will have withdrawn from the zone of danger as the result of the act R_5. In case R_5 is an act of attack rather than flight it must, to be successful, bring the organismic series into contact with the world sequence in such a manner as to interrupt the latter before S_5 is reached. In this case also, the organism clearly escapes the injury. Thus the supposed impossibility of an organismic reaction to a situation before it exists as a stimulus is accomplished quite naturally through the medium of an internal substitute stimulus.

III

A reflective consideration of the habit mechanisms involved in anticipatory defense reactions reveals a phenomenon of the greatest significance. This is the existence of acts whose sole function is to serve as stimuli for other acts. We shall accordingly call them *pure stimulus acts*. Under normal conditions practically all acts become stimuli, but ordinarily the stimulus function is an incidental one. The consideration of the approach of an organism to food may clarify the concept. Each step taken in approaching the food serves in part as the stimulus for the next step, but its main function is to bring the body nearer the food. Such acts are, therefore, primarily instrumental. By way of contrast may be considered the anticipatory defense sequence presented above. R_5, the actual defense reaction, obviously has instrumental value in high degree. R_4, on the other hand, has no instrumental value. This does not mean that it has no significance. Without R_4 there would be no s_4, and without s_4 there would be no R_5 *i.e.*, no defense. In short, R_4 is a pure stimulus act. In the same way R_3 and R_2 serve no instrumental function but, nevertheless, are indispensable as stimulus acts in bringing about the successful defense response.

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[2] C. L. Hull, A functional interpretation of the conditioned reflex, *Psychol. Rev.*, 1929, **36,** p. 507 *ff*. A quite distinct mechanism serving much the same function as that here emphasized has its basis in the peculiar advantage afforded by distance receptors. The stimulus of a distant object through a distance receptor is often sufficiently like that when the object is near and nocuous to evoke a successful defense reaction before the source of danger can get near enough to produce injury. This has been discussed in detail by Howard C. Warren, *J. Phil., Psychol. & Scient. Meth.*, 1916, **13,** p. 35 *ff*.

A simple experiment which can be performed by anyone in a few moments may still further clarify the concept of the pure stimulus act. Ask almost any psychologically naïve person how he buttons his coat with one hand—which finger, if any, he puts through the buttonhole, what the last act of the sequence is—and so on. The average person can tell little about it at first. If wearing a coat, he will usually perform the act forthwith. If warned against this, the hand may quite generally be observed to steal close to the position at which the buttoning is usually performed and to go through the buttoning behavior sequence *by itself*. After this the nature of the final buttoning act may be stated with some assurance. Clearly, the earlier acts of this pseudo-buttoning sequence are pure stimulus acts since they serve no function whatever, except as stimuli to evoke succeeding movements and ultimately, the critical final movement which is sought.

It is evident upon a little reflection that the advent of the pure stimulus act into biological economy marks a great advance. It makes available at once a new and enlarged range of behavior possibilities. The organism is no longer a passive reactor to stimuli from without, but becomes relatively free and dynamic. There is a transcendence of the limitations of habit as ordinarily understood, in that the organism can react to the not-here as well as the not-now. In the terminology of the *Gestalt* psychologists, the appearance of the pure stimulus act among habit phenomena marks a great increase in the organism's "degrees of freedom." The pure stimulus act thus emerges as an organic, physiological—strictly internal and individual—symbolism. Quite commonplace instrumental acts, by a natural reduction process, appear transformed into a kind of *thought*—rudimentary it is true, but of the most profound biological significance.

Thus the transformation of mere action into thought, which has seemed to some as conceivable only through a kind of miracle, appears to be a wholly naturalistic process and one of no great subtlety. Indeed, its obviousness is such as to challenge the attempt at synthetic verification from inorganic materials. It is altogether probable that a "psychic" machine, with ample provision in its design for the evolution of pure stimulus acts, could attain a degree of freedom, spontaneity, and power to dominate its environment, inconceivable alike to individuals unfamiliar with the possibilities of automatic mechanisms and to the professional designers of the ordinary rigid-type machines. . . .

15.

Mediated Generalization and the Interpretation of Verbal Behavior: I. Prolegomena*[1]

Charles N. Cofer and
John P. Foley, Jr.[2]

Since Watson's epoch-making hypothesis relating thinking to sub-vocal speech, psychologists have emphasized, to a greater or lesser degree, the important rôle which language mechanisms (verbal, manual, postural, etc.) play in complex human behavior. Although there has been much speculation regarding the nature and function of linguistic behavior, relatively few experimental data are available as the basis for systematized theory in this area. In fact, language mechanisms have often been regarded as "uncontrolled variables" in psychological investigations.

The present paper reports an attempt (1) to extend the objective principles derived from conditioned response experimentation to certain aspects of linguistic behavior, and (2) to show how such an interpretation of language behavior throws light on other psychological phenomena in which language plays an important rôle. It should be emphasized at the outset that not only are the conditioned response principles (e.g., reinforcement, generalization) here employed well established and generally accepted, but their validity as principles of linguistic behavior has been determined by direct experimentation, as will be noted from the survey of related experiments below, although the implications of such experiments for psychological theory do not appear to have been fully recognized.

Language is here regarded as a form of conditioned behavior—both on the part of the speaker and on the part of the person spoken to. This objective psychological approach to language behavior differs considerably from the philological

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* From C. N. Cofer and J. P. Foley, Mediated generalization and the interpretation of verbal behavior: I. Prolegomena, *Psychol. Rev.*, **49,** 513–540 (1942). Reprinted by permission of the authors and the American Psychological Association.

[1] The present paper represents the theoretical background for research being conducted by the writers under a grant-in-aid from the American Association for the Advancement of Science.

[2] The writers wish to express their appreciation to the following persons who read and criticized a preliminary copy of the present paper: Professor C. H. Graham, Professor E. R. Guthrie, Professor C. L. Hull, Professor J. McV. Hunt, Professor W. S. Hunter, Dr. Margaret Keller, Dr. F. A. Mote, Professor Harold Schlosberg.

and related approaches in which the major interest is in language morphology, i.e., language as things—isolated words or syllables. It also differs fundamentally from the logical discipline of semiotics (*cf.* Morris, 16), which is concerned with the systematic elaboration of the meta-language in terms of which all sign situations may be classified and discussed. And it should be further emphasized that the study of language-as-conditioned behavior has no traffic with mentalistic theories which regard language as a means of "expressing ideas." For a comparison of these different approaches to language as well as for an objective psychological treatment of grammar, the reader is referred to Kantor (8).

I. Experimental Background and Operational Analysis

In the following paragraphs, we shall begin with a brief consideration of the phenomenon of generalization, followed by a discussion of the distinction between mediated and non-mediated (physical) generalization. Attention will then be directed to the problem of mediated verbal generalization,[3] after which the experiments in this field will be classified and the more relevant ones briefly summarized. The present section will conclude with a theoretical analysis of mediated generalization as a specific conditioned response phenomenon.

The phenomenon of generalization or irradiation of conditioned responses refers to the empirically determined fact that if a conditioned response is established to a given stimulus (S_1), other stimuli (S_{2-n}) of the same dimension will elicit the response without reinforcement, the magnitude of the generalized response varying inversely with the distance of S_{2-n} from S_1 along the given dimension.[4] Such stimulus equivalence or gradients of generalization have been experimentally demonstrated in the case of various stimulus dimensions, such as the pitch or loudness of tones, as determined by psychophysical experiments, and the spatial distance of tactual stimuli applied to the body surface.

Several investigators have recently shown that generalization occurs along a *semantic gradient,* although the mechanisms involved need to be clarified and extended by theoretical implication. If we omit all other experiments in which conditioned responses have been formed to verbal stimuli[5] and consider only those directly concerned with semantic generalization, we may classify the investigations into three major categories.[6] The first of these comprises *experiments in which a conditioned reaction has been established to a stimulus object (denotatum) and generalization obtained to its name (sign)*. Positive results of this type have been reported by Kapustnik (9), Keller (10), Kotliarevsky (11, 12), Nevsky and Levin (17), Razran (19), Smolenskaya (27), Traugott (29), and Traugott and Fadeyeva (30). Conversely, Kapustnik (9), and Shastin (25), have described *experiments in which conditioned reactions have been established to a word (sign) and generalization obtained to its object (denotatum)*. A third type of experiment has been concerned with the *establishment of a conditioned reaction to one word (sign) and generalization to other semantically and phonetically related words (signs)*. Experiments by Diven (3), Keller (10), Razran (20, 21, 22), Riess (23, 24), and Wylie (32) are concerned with this problem. Since they are most relevant to the present paper, these experiments may be briefly described.

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[3] We recognize the possibility of linguistic mediated generalization gradients of a non-verbal nature, as in the case of sign and gesture languages. Mediated generalization in some form undoubtedly occurs in such instances, and it would be interesting to study the generalization gradients in these language systems.

[4] We are not concerned here with the phenomenon of response equivalence, or response generalization.

[5] Noteworthy among such studies have been those on the conditioned acquisition of voluntary control of previously involuntary responses, as well as those on the effect of positive and negative attitudinal factors on conditioning. Although both of these areas of investigation are relevant to the present problem of semantic generalization, no attempt will be made to consider them here. Similarly, the experiments on indirect or mediated conditioning (Shipley, N. E. Miller, Lumsdaine) are arbitrarily omitted from the present discussion, owing to the fact that the mediated generalization is not semantic in character.

Razran (20) measured the amount of saliva secreted while he thought of "saliva" in English, Russian, German, French, Spanish, and Polish. As controls he used the Gaelic word for saliva, with which he was unfamiliar, a pair of nonsense syllables, and a period of "blank consciousness." A quantitative index of his familiarity with these languages was obtained through his speeds of reading and of association in each. The results indicated that the largest amount of saliva[7] was secreted for the Russian word, the language of his childhood and adolescence, in spite of the fact that he is now more fluent in English. The German, French, Spanish, Gaelic, and Polish words yielded decreasing amounts of saliva in this order, which was the order of his familiarity with the languages, except for a reversal between Gaelic and Polish. Thus the degree of generalization appeared to vary as a function of his knowledge of or frequency of use of the specific languages, although the results, obtained on a single subject, are tentative.

A quantitative study of semantic conditioning in three adult human subjects is elsewhere reported by Razran (21). An attempt was made to separate the semantic or meaning-content factor from the phonetic or visual-auditory form of the word by the use of synonyms and homophones. Four stimulus words (*style, urn, freeze, surf*) were flashed on a screen while the subjects were eating, the amount of salivation to each of the stimulus words and subsequently to each of the homophones (*stile, earn, frieze, serf*) and synonyms (*fashion, vase, chill, wave*) being tested.[8] The mean generalization was 59 per cent to the synonyms and 37 per cent to the homophones, thus indicating that the verbal conditioning was largely semantic.

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[6] In his description of methods for studying conditioned reflexes in man, Ivanov-Smolensky (7) includes a discussion of verbal conditioning, but neither the original monograph nor a complete abstract was available to the writers. References to two other volumes edited by Ivanov-Smolensky, and presumably including a summary of experiments on verbal conditioning and semantic generalization performed by students in his laboratory, are cited by Razran (**21**, p. 90, footnotes 1 and 2).

[7] Measured by means of Razran's 'cotton technique,' which consists in ascertaining the increment in weight of an absorbent dental cotton roll inserted under the subject's tongue for a period of one minute.

[8] *Ibid.*

Riess (23) has repeated Razran's experiment, using the same stimulus and test words but employing the galvanic skin reaction (GSR) to a loud buzzer as a substitute for the salivary technique. The number of subjects varied from 4 to 9 in the case of the four stimulus words. Riess also found generalization to be greater to the synonyms than to the homophones, the mean percentage gain from conditioning being 94.5 for the homophones and 141.0 for the synonyms. In a recent unpublished study Riess (24) has included antonyms and has studied generalization at different age levels. Results appear to indicate that in young children generalization is greater to the homophones than to the synonyms, with the antonyms intermediate between the two, thus suggesting the relatively greater importance of phonetic as compared with semantic factors in the behavior of young children. With adults, however, the relationship is reversed, the order of increasing amount of generalization being: homophones, antonyms, synonyms.

Wylie (32) repeated the experiment performed by Razran and Riess, conditioning the GSR (elicited by shock) to certain words and testing generalization not only to homophones and synonyms of these words but also to other words (controls) bearing no relationship to the conditioned words. She found evidence of greater generalization to the homophones and to the synonyms than to the control words, but her results indicated greater generalization to the homophones than to the synonyms. This variation from the findings of Razran and Riess may, perhaps, result from the fact that her subjects said they expected shock on the words that sounded like the conditioned words but not on the synonyms of those words. Had her subjects been misled as to the nature of the experiment, this result might not have occurred. Wylie further studied semantic generalization by using nonsense syllables. Her subjects learned several pairs of syllables by the paired associates method, and the first members of two of these pairs were then conditioned. Generalization was found to be much greater to the syllables associated with the conditioned syllables than to those syllables associated with nonconditioned syllables.

Another experiment by Razran (22) followed the same general method as that described three paragraphs above. For single-word conditioning, semantic factors were again found to be the most important determiners of the amount of salivary generalization in the adult subject, although "phonetographic" relationships (sound-spelling, e.g., *dark, mark*) were also very significant, especially at the beginning of the conditioning and after long continued pairings. Syntactic generalization was also studied by conditioning a salivary reaction to a 3-word sentence (consisting of subject, copula, and predicate) and then testing for generalization to other 3-word sentences in which one or more of the three words was reversed—giving rise to 7 verbal variations and to 4 contradictory and 3 concordant statements (e.g., *Poverty is degrading: Wealth is degrading, Poverty is not degrading, Poverty is not uplifting, Wealth is uplifting,* etc.). Results indicated that the amount of generalization obtained depended upon the following factors (in decreasing order of strength of generalization): general agreement of statement, agreement of copula, predicate, subject, but reversals of copulas interfered more with transfer than general reversals of statements. Razran also reported that conditioned single words lost some of their generalization-strengths when combined in sentences, and that subjects' opinions regarding the truth of the statement influenced the conditioning as well as the generalization value of the sentence.

In a study designed to investigate the conditioning of anxiety reactions (GSR) to words, Diven (3) found generalization spreading "by meaningful relation" to other words in the series. For example, from the reinforced word *barn*, generalization occurred to other words in a "rural" category.

In a somewhat different experiment, still in its preliminary stages, Keller (10) has found that when the GSR is conditioned to the picture of an object, there is generalization to the name of the object. She has also shown that a conditioned response established to one picture of an object (e.g., a hat) will be generalized to the picture of another object in the same category (e.g., another hat). In part, this last result might be attributed to physical similarity of the pictures of the objects, but there may also be a factor of *conceptual identity* in the different pictures which is in part responsible for the generalization.

Let us now turn to a consideration of mediated as compared with non-mediated generalization. It will be noted that *the dimension along which generalization occurs in the experiments described above is not a dimension characteristic of the physical attributes of the stimuli.* The classical formulation of generalization principles presupposes naive organisms (cf. Hull, 5), whereas *mediated* (e.g., *semantic*) *generalization depends upon previously conditioned* (*usually language*) *behavior.* Razran (19, pp. 70–71) implies this distinction in his "polymodal concept" of human conditioning, according to which the mean amount of conditioning is held to be a function of (1) a *physiological factor* dependent upon the 'biological potency' of the stimulus and its correlated 'physiological reaction-change' and (2) a *psychological factor* resulting from the associational history and patterning of the stimulus. A similar distinction has been made by Hull (6) in a discussion of the problem of stimulus equivalence in behavior theory.[9] Hull suggests that the three mechanisms mediating stimulus equivalence are: (1) the *partial physical identity* of the stimulus compounds, (2) *primary or physiological generalization* (irradiation), and (3) *secondary or indirect generalization* through the arousal of a reaction previously conditioned to the same stimulus continuum. Hilgard and Marquis (4, p. 201, italics ours) summarize the problem of generalization and the definition of stimulus similarity as follows:

> There are a number of types of equivalence between stimuli (and the responses which they evoke) which cause the stimuli to be reacted to as similar, so that conditioned responses formed to one of the stimuli will be generalized to the other. Among these may be mentioned: *partial identity* (whereby stimulus A–B is similar to A–C); *sensory similarity* (so that two colors are more alike than a color and a tone); *formal similarity* (for example, two patterns of ascending pitch); *affective similarity* (equivalence mediated by emotionally flavored processes, as in the "dark brown taste" or "blue Monday"; and *mediated similarity*

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[9] Many of these distinctions bear a resemblance to Kantor's interbehavioristic "stimulus function."

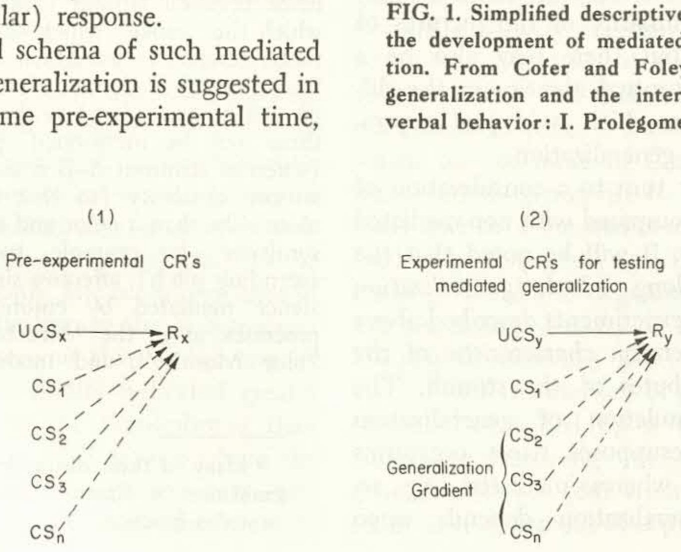
(as in the equivalence of words of different sounds, but of common meanings). Of these relationships, only the first (partial identity) may be conceived of as physical similarity. The second (sensory similarity) may be mediated by relatively primitive physiological processes, as represented in the classical experiments on generalization within a sensory modality. The others all depend upon relatively complex processes, many of which require previous learning in order that the stimuli involved may be responded to as similar.

It is with this final type of "mediated" generalization that we are here concerned. It is clear that semantic generalization would not take place in the case of a subject who did not know the meaning of the words or who saw no conceptual identity or similarity in the pictures of the hats in Keller's experiment. The mediated or semantic generalization in such experiments thus presupposes and depends upon the pre-experimental formation of conditioned responses or associations, i.e., *the gradient of generalization is a gradient along a dimension of conditioned stimulus functions.* The stimuli need be similar only in so far as they have been previously conditioned to the same (or similar) response.

A simplified schema of such mediated or semantic generalization is suggested in Fig. 1. At some pre-experimental time, the subject has become conditioned, either by direct reinforcement or by higher order conditioning, to make R_x to CS_1, CS_2, CS_3 . . . CS_n. The subject is next experimentally conditioned by reinforcing CS_1 with UCS_y, setting up a conditioned response, R_y. Generalization is now found to CS_2 . . . CS_n, the magnitude of the generalized response presumably depending upon the relative strengths of the pre-experimental conditioning of CS_1 . . . CS_n to R_x.

It should be emphasized that the schema in Fig. 1 is an operational account of what descriptively occurs in mediated generalization. Hypotheses regarding further, non-observable mechanisms could be introduced with reference to the manner in which generalization may be said to occur along the previously-conditioned stimulus-response continuum. Thus one might assume, following the theoretical analysis of Guthrie, Hull, and others, that upon the pre-experimental conditioning of CS_1 . . . CS_n to R_x, each of these stimuli is also conditioned to an implicit, fractional, kinesthetic r_x, which invar-

FIG. 1. Simplified descriptive schema for the development of mediated generalization. From Cofer and Foley: Mediated generalization and the interpretation of verbal behavior: I. Prolegomena.



iably occurs with each pre-experimental reinforcement of R_x. In the later, experimental situation, CS_1 is conditioned to R_y. But during each reinforcement of this conditioning, CS_1 evokes r_x, the proprioceptive stimulation (s_x) from which also becomes conditioned to R_y. Now, when $CS_2 \ldots CS_n$ is presented alone for testing mediated generalization, it will evoke r_x, whose s_x will in turn elicit R_y.[10] Thus, from a purely molar or descriptive point of view, $S_2 \ldots S_n$ will lead directly to R_y. A diagrammatic representation and more detailed discussion of these inferred mechanisms are presented by Hull (6, pp. 27–28).

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[10] Evidence concerning the role of such mediating responses is found in a series of different experiments by Miller (13, 14), designed to test the influence of past experience upon the transfer of subsequent training. Although both rodent and human subjects were used in different experiments, our present interest is in the verbal behavior of the latter. One such experiment made use of numbers and letters as different material categories pre-experimentally acquired and inter-associated by the subjects. A conditioned GSR differentiating between a specific number and a specific letter was set up, and differential generalization was found to other numbers and letters which had not been subject to direct reinforcement (cf. 13, p. 70). In further series of experiments, "controlled patterns of association were established through the learning of nonsense syllables. Possible effects of original similarities between pairs of syllables were eliminated by the systematic use of the same syllables in different patterns of association for different subjects. Differential conditioned galvanic reactions were established to a pair of stimuli by shock and non-shock combinations after which the previous associates of the shock and non-shock pair were presented without shock. Photographic records of the responses showed contrasting reactions to the syllables associated to the shock and non-shock elements of the primary conditioning pair" (13, "Digest" inserted in front of "Table of Contents"). "Additional experiments on human subjects demonstrated that (a) galvanic reactions may be conditioned to the stimuli involved in the subject's own verbal responses; (b) conditioned reactions of this type are subject to experimental extinction; (c) under certain circumstances, the functional activity of the verbal response previously associated with both members of a pair of stimuli may be essential to the subsequent transfer of conditioning from one of these stimuli to the other; and (d) under certain circumstances this crucial role of the mediating verbal response may be demonstrated—with dynamically opposite effects—for the transfer of either the positive or the negative aspects of a differential conditioned galvanic response" (13, p. 70). Miller thus concludes that the evidence (from both human and rodent subjects) in his series of experiments "demonstrates the influence of previous associations upon the generalization of subsequent conditioning and indicates that mediating responses can play an important role in this transfer" (13, "Digest").

Miller and Dollard (15, p. 77) report an unpublished dissertation by Birge (1) in which behavioral generalization in children was found to be mediated by verbal responses. Birge found that "if young children are taught to call two very different stimulus objects by the same name, other responses (such as reaching for the objects) are more likely to generalize from one to the other than when the two objects have been given different names." Birge likewise noted that "such generalization is much more likely to occur when the children say the name aloud, so that it is certain that the cue-producing response is actually present, than when they do not say the name aloud" (15, p. 77). Miller and Dollard (15, pp. 74–78) also discuss the rôle of the mechanism of mediated generalization in various forms of adult social behavior.

II. Formal Illustration, Methods of Experimental Demonstration, and Implications for Behavior Theory

In this section an attempt will be made to extend the previous analysis and to illustrate its application to various psychological situations. More specifically, the section will begin with the discussion of a formal system of notation for designating mediated (*i.e.*, synonym) and non-mediated (*i.e.*, homophone) generalization gradients, after which the discussed synonym and homophone relationships will be illustrated by application to an hypothetical subject. A number of other gradients (other than synonym and homophone) along which mediated generalization might be expected to occur will next be suggested. A minimum number of formal concepts essential to the present theory will then be presented, followed by a discussion of methods for experimental check or demonstration of the expected relationships in the case of a given subject. . . .

The implications of semantic generalization for behavior theory, especially when combined with non-semantic or physical (e.g., phonetic) generalization, appear not to have been adequately recognized. The relationships explicated in Fig. 1 may be regarded as a generalized statement of the nature of mediated stimulus equivalence. We are here interested in one form of mediated generalization, *viz.*, that involved in verbal language behavior; we are also concerned with non-mediated generalization insofar as it plays a part in these problems.

In Fig. 2 we have suggested certain formal relationships which might be expected to obtain in the case of an organism whose language behavior is highly developed. Mediated generalization is here depicted in terms of synonymity of words and non-mediated generalization in terms of homophonymity of words. The following set of definitions will explain the system of notation used in this figure:

P refers to the original, reinforced stimulus (presentation) word.

S refers to a synonym of *P*.

H refers to a homophone of *P*.

N refers to a neutral word.

Numbers in parentheses designate the number of semantic or phonetic transformations removed from *P*.

S_s refers to a synonym of the preceding synonym.

S_h refers to a synonym of the preceding homophone.

H_s refers to a homophone of the preceding synonym.

(No notation is required for a homophone of a preceding homophone. *Cf.* below.)

A prime ($'$), or primes ($''$ or $'''$), is used to differentiate various words or various sets of words which are synonyms or homophones of the preceding word but not synonyms or homophones of each other.

A long bar (——) is used to cover a set of words (synonyms) which are also synonyms of each other. It is extremely unlikely that there will be a set of homophones which are synonyms of each other.

It is evident that if two or more words are homophones of a preceding word they will be homophones of each other. It is extremely unlikely that there will be a set of synonyms which are homophones of each other.

It will be noted that Fig. 2 is a formal representation of some of the possible

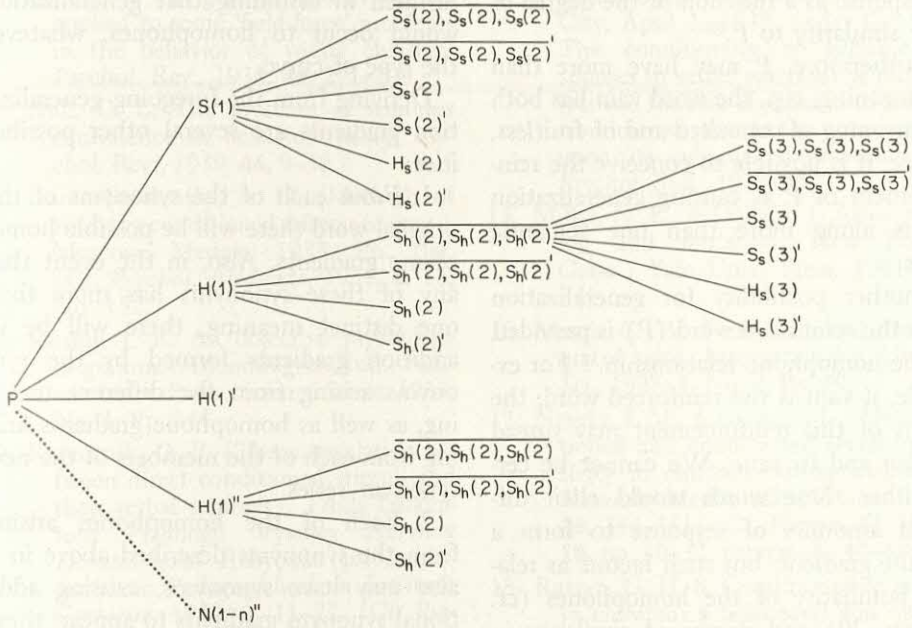

FIG. 2. Formal illustration of certain phonetic and semantic (mediated) generalization gradients in hypothetical subject. From Cofer and Foley: Mediated generalization and the interpretation of verbal behavior: I. Prolegomena.

*** For experimental purposes it is necessary to have a neutral (control) word, *N*, at every stage in the diagram; a set of such neutral words bearing the relationship of synonymity or homophonity to each other could also be utilized as additional controls.**

relationships arising from certain phonetic and semantic (mediated) generalization gradients. A given word, *P*, is presented and reinforced. According to the data of Diven (3), Razran (21, 22), Riess (23, 24), and Wylie (32), synonomous words, when presented, will likewise elicit a response, though less in degree. Now *P* may have only one synonym or it may also have several synonyms; in the latter case these several synonyms may not bear to *P* the same degree of semantic relationship, *i.e.*, one word (synonym) may be more completely interchangeable with *P* than the others although all must bear some degree of interchangeability with *P*. (In this connection it should be noted that language authorities seldom assert that two words have precisely the same meaning. It seems likely, therefore, that the foregoing statement is sound.)[11] Therefore, we may have a series of words, varying in semantic similarity to *P*, which would be likely to elicit different degrees of response as a function of the degree of their similarity to *P*.[12]

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[11] It is necessary to remember that the relation of synonymity in the language behavior of persons is dependent upon previous associations (conditioning). Hence, we cannot expect generalization gradients to picture the dictionary semantic relationships but should expect them to vary with the particular individual in the light of his language history. *Cf.*, e.g., Mosier, C. I., A psychometric study of meaning. *Psychol. Bull.*, 1939, **36**, 607–608, and *J. soc. Psychol.*, 1941, **13**, 123–140.

Furthermore, *P* may have more than one meaning; e.g., the word *vain* has both the meaning of *conceited* and of *fruitless*. Hence, it is possible to conceive the reinforcement of *P* as causing generalization effects along more than one semantic series.

Another possibility for generalization from the reinforced word (*P*) is provided by the homophone relationship.[13] For example, if *vain* is the reinforced word, the effects of this reinforcement may spread to *vein* and to *vane*. We cannot be certain that these words would elicit different amounts of response to form a definite gradient, but such factors as relative familiarity of the homophones (*cf.* Razran, 20) and degree of similarity in spelling might cause a definite gradient to appear.[14] At any rate, we are probably justified in assuming that generalization would occur to homophones, whatever the type of curve.

Deriving from the foregoing generalization gradients are several other possibilities:

1. From each of the synonyms of the original word there will be possible homophone gradients. Also, in the event that any of these synonyms has more than one distinct meaning, there will be in addition gradients formed by the synonyms arising from the different meaning, as well as homophone gradients arising from each of the members of the new synonym series.

2. Each of the homophones arising from the synonyms described above in 1 also may have synonyms, causing additional synonym gradients to appear; these synonyms may have homophones, more than one meaning, etc. The number of possible gradients is thus extended to a very large number.

3. Each of the members of the series of words homophonous with respect to *P* may have synonyms,—several sets of synonyms in the cases of words having more than one meaning. Each of these synonyms may have homophones, and so on. . . .

REFERENCES

1. Birge, J. S. The rôle of verbal responses in transfer. Ph.D. dissertation, Yale University, 1941. Pp. 76.
2. Cofer, C. N. An analysis of errors made in the learning of prose material. *Psychol. Bull.*, 1941, **38,** 726.
3. Diven, K. Certain determinants in the conditioning of anxiety reactions. *J. Psychol.*, 1937, **3,** 291–308.
4. Hilgard, E. R., & Marquis, D. G. *Conditioning and learning.* New York: Appleton-Century, 1940. Pp. 429.

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[12] *Ibid.*

[13] There are many possibilities here. In the text we are chiefly concerned with words, conventionally designated as homonyms or homophones, which are alike in sound but not in spelling and meaning. Homographs could also be considered, both when the words have the same sound and spelling but different meanings (e.g., *fair, beautiful* and *fair, market*) and when the words are spelled alike but differ in both sound and meaning (e.g., *bow, knot* and *bow, forward part of a vessel*). Likewise, we have said nothing concerning the place of the antonym in this picture. Generalization along each of these (and other) continua could readily be investigated.

[14] It should also be noted that partial identity in sound or spelling might be adequate for some generalization to appear. For example, if *lamp* be the reinforced word, generalization might appear to such words as *tramp, cramp, camp,* etc. *Cf.* Razran (22).

5. Hull, C. L. The goal gradient hypothesis applied to some 'field-force' problems in the behavior of young children. *Psychol. Rev.*, 1938, **45,** 271–299.
6. Hull, C. L. The problem of stimulus equivalence in behavior theory. *Psychol. Rev.*, 1939, **46,** 9–30.
7. Ivanov-Smolensky, A. G. (Methods of studying conditioned reflexes in man.) Moscow: Medgiz, 1933. Pp. 104. (*Cf. Psychol. Abstracts*, 1934, **8,** 18, No. 152.)
8. Kantor, J. R. An objective psychology of grammar. Bloomington, Ind.: *Indiana Univ. Pubs., Science Series*, 1935, No. 1. Pp. 344.
9. Kapustnik, O. P. (The interrelation between direct conditioned stimuli and their verbal symbols). *Trudy Laboratorii Fiziologii Vysshey Nervnoy Deyatel'-nosti Rebyonka pri Leningradskom Pedagogicheskom Institute Gertzena*, 1930, **2,** 11–22. (*Cf. Psychol. Abstracts*, 1934, **8,** 18, No. 153.)
10. Keller, M. Personal communication to the writers.
11. Kotliarevsky, L. I. (The formation of pupillary conditioned reflexes and a differentiation in response to both direct and verbal stimuli.) *Arkhiv Biologicheskikh Nauk* (*Arch. Sci. Biol.*), 1935, **39** (2), 477–489. (*Cf. Biol. Abstracts*, 1937, **11,** 1462, No. 13724.)
12. Kotliarevsky, L. I. (Cardio-vascular conditioned reflexes to direct and to verbal stimuli.) *Fiziol. Zh. S.S.S.R.*, 1936, **20,** 228–242. (*Cf. Psychol. Abstracts*, 1939, **13,** 411–412, No. 4046.)
13. Miller, N. E. The influence of past experience upon the transfer of subsequent training. Ph.D dissertation, Yale University, 1935. Pp. 73 and 4 appendices.
14. Miller, N. E. The influence of past experience upon the manner in which new training is generalized: an analytical study employing the conditioned response technique. *Unpublished manuscript*. Read at meeting of Eastern Psychological Association, New York City, April 1, 1938, under the title, The conditioning of galvanic responses to verbal reactions of the subject and the rôle of patterns of association learned prior to this conditioning upon its subsequent generalization. *Psychol. Bull.*, 1938, **35,** 531.
15. Miller, N. E., & Dollard, J. *Social learning and imitation*. New Haven, Conn.: Yale Univ. Press, 1941. Pp. 341.
16. Morris, C. W. Foundations of the theory of signs. *Internat. Ency. Unified Sci.*, 1938, **1,** No. 2. Pp. 59.
17. Nevsky, I. M., & Levin, S. L. (Unconditioned and conditioned secretory activity in children during hypnosis.) *Kazansky Meditzinsky Zhurnal*, 1932, **28,** 344–351. (*Cf.* Razran, G. H. S., **18,** pp. 30–32, paragraphs 40–41.)
18. Razran, G. H. S. Conditioned responses in children: a behavioral and quantitative critical review of experimental studies. New York: *Archives of Psychol.*, 1933, No. 148. Pp. 120.
19. Razran, G. H. S. Conditioned responses: an experimental study and a theoretical analysis. New York: *Archives of Psychol.*, 1935, No. 191. Pp. 124.
20. Razran, G. H. S. Salivating, and thinking in different languages. *J. Psychol.*, 1935–1936, **1,** 145–151.
21. Razran, G. H. S. A quantitative study of meaning by a conditioned salivary technique (semantic conditioning). *Science*, 1939, **90,** 89–90.
22. Razran, G. H. S. Semantic, syntactic, and phonetographic generalization of verbal conditioning. *Psychol. Bull.*, 1939, **36,** 578.
23. Riess, B. F. Semantic conditioning involving the galvanic skin reflex. *J. exp. Psychol.*, 1940, **26,** 238–240.
24. Riess, B. F. Personal communication to the writers.
25. Shastin, N. R., summarized by Krasnogorski, N. I. Bedingte und unbedingte Reflex im Kindesalter und ihre Bedeutung für die Klinik. *Ergeb. d. Inner.*

Mediz. und Kinderhk., 1931, **39,** 613–730. (*Cf.* Razran, G. H. S., **18,** p. 23, paragraph 28.)

26. Skinner, B. F. The verbal summator and a method for the study of latent speech. *J. Psychol.*, 1936, **2,** 71–107.
27. Smolenskaya, E. P. (Verbal symbols of conditioned and differential stimuli.) *Na Putyakh k Izuch. vysshykh Form Neirodin. Reb.*, 1934, 304–315. (*Cf. Psychol. Abstracts*, 1935, **9,** 131, No. 1163.)
28. Thorndike, E. L. Mental dynamics shown by the abbreviation and amelioration of words in hearing and remembering. *Amer. J. Psychol.*, 1941, **54,** 132–133.
29. Traugott, N. N. (The interrelations of immediate and symbolic projections in the process of the formation of conditioned inhibition.) *Na Putyakh k Izuch. vysshykh Form Neirodin. Reb.*, 1934, 273–303. (*Cf. Psychol. Abstracts*, 1935, **9,** 131, No. 1166.)
30. Traugott, N. N., & Fadeyeva, V. K. (The effect of difficult extinction of food-procuring reflexes upon the general and speech behavior of children.) *Na Putyakh k Izuch. vysshykh Form Neirodin. Reb.*, 1934, 316–403. (*Cf. Psychol. Abstracts*, 1935, **9,** 131–132, No. 1167.)
31. Woodworth, R. S. *Experimental psychology*. New York: Holt, 1938. Pp. 889.
32. Wylie, R. C. Generalization of semantic conditioning of the galvanic skin response. Unpublished M.A. thesis, University of Pittsburgh, 1940. Pp. 40.

16.

Mediated Verbal Similarity as a Determinant of the Generalization of a Conditioned GSR*[1]

Laura W. Phillips

The generalization or "spread" of CR's to stimuli on the same dimension as the CS has been studied extensively. With human Ss, generalization along such dimensions as tonal frequency (7), tonal intensity (8), and spatial distances along the skin (1) has been investigated. Generalization of the salivary CR along verbal dimensions has been explored by Razran (12), and the same verbal dimensions were employed in a study by Riess (13), using the conditioned galvanic skin re-

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* From L. W. Phillips, Mediated verbal similarity as a determinant of the generalization of a conditioned GSR, *J. exp. Psychol.*, **55,** 56–62 (1958). Reprinted by permission of the author and the American Psychological Association.

[1] This research represents a major portion of a thesis submitted in partial fulfilment of the requirements for the degree of Master of Arts in the Department of Psychology of the University of California in 1953. The writer wishes to express her appreciation to Professors Leo J. Postman and Edwin E. Ghiseli for guidance and advice in this research, and to Professor Mark R. Rosenzweig for technical assistance in the use of the Garceau Clinical Dermohmeter and in evaluation of the readings.

sponse (GSR). Both investigators found that the CR generalized to meaningful synonyms, e.g., from "urn" to "vase," more than to phonetographically similar words such as from "urn" to "earn."

Cofer and Foley have applied Hull's principles of primary and secondary generalization in an analysis of language behavior (2). They have demonstrated homophone, synonym, and antonym generalization by preliminary training with lists of words related to a test list along these dimensions (3, 4). However, the scaling of verbal similarity employed by these investigators suffers from methodological difficulties. First, it is difficult to isolate a single verbal dimension. For example, a given synonym dimension is likely to be confounded with other synonym dimensions as well as with various homophone, pseudo-homophone and antonym dimensions, to mention only a few possibilities (2, 3, 4). This method of scaling encounters further problems in connection with the determination of equal scale intervals.

To overcome these difficulties, it seems necessary to choose verbal stimuli which are initially devoid of meaning and to induce varying degrees of similarity among them under controlled conditions of associative learning. The degree of similarity can then be defined and measured with reference to the conditions of preliminary training.

The purpose of the present study was to investigate the generalization of a CR along an experimentally produced dimension of verbal similarity. The method chosen for producing varying degrees of similarity among a series of verbal stimuli was that of establishing associative connections between nonsense words and points along a well-established sensory dimension (in this case, brightness). When associations between members of a series of verbal stimuli and members of a series of brightness stimuli have been established, it is assumed that an associative relationship will exist among the words themselves, *mediated* by the associations between the words and different positions along the sensory scale. Such a mediated similarity scale would be manifest by Ss' subsequent responses under relevant test conditions.

The experiment attempted to answer two questions: (*a*) Can a scale of mediated verbal similarity be established? (*b*) What is the nature of the generalization gradient as a function of such a similarity scale?

Method

MATERIALS

The stimuli used were: (*a*) five seven-letter Turkish words (14) typed on 5-in. by 3-in. cards and presented in random orders; (*b*) five Munsell grays of the values N1/, N3/, N5/, N7/, and N9/ respectively from dark to light (10).[2] The five values chosen constituted a series of equal sense distances, 100 JND's separating successive scale positions. Three sets of the five grays were cut into 1⅛ in. circles and mounted on 6-in. by 18-in. white cards. The values of the grays were ordered differently on each of the white cards according to a restricted randomization, i.e., they never appeared in the order of their scale values. These three displays made it possible to vary the spatial positions of the different grays from trial to trial.

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[2] The author wishes to express appreciation to Professor Gordon L. Walls of the Optometry Department of the University of California for his expert advice in choosing the values of the Munsell grays and for preparing the color circles used in the experiment.

For purposes of experimental training, each of the Turkish words was paired with one of the gray circles. The particular word-color combinations were varied from S to S. Five different sets of paired associates were used in rotation.

PROCEDURE

The experimental period was divided into three parts: a training session devoted to establishing associative connections between the words and the points on the brightness dimension; a conditioning session in which one of the words was used as a CS and the other words were used in tests for generalization; and, finally, a short association test based on the previously learned words.

Training session.—The Ss were instructed to learn the paired associates as a memory task, and to pronounce the words as though they were English. The training procedure began with an initial presentation of the paired stimuli in the following manner: E showed each word card to S once and pointed to the gray circle paired with it while S pronounced the word. Paired-associate training trials were then carried out as follows: (*a*) E pointed to a circle while S was required to pronounce the word which had been previously presented with that color; (*b*) a word card was shown to S, he pronounced the word and was required to point simultaneously to the correct color circle. The five words or colors were used as stimuli or responses respectively in the above manner randomly within each trial in order to equalize the strengths of the associations in both directions, i.e., word-color, and color-word. A trial consisted of the presentation of the five pairs in the manner described under (*a*) and (*b*).

A 3-sec. interval was allowed between the presentation of the words or colors and S's response. If S did not respond within 3 sec., E gave the response by indication, i.e., by pointing to a color or showing a word card, and S repeated it by pronouncing the word and pointing to the color. The E confirmed or corrected each response by indication, and S repeated each correction. An interval of 5 sec. elapsed between S's response and the next stimulus presentation. A 10-sec. intertrial interval was allowed in order to change the color-display and word-card orders.

The trials were continued until S learned to a criterion of three perfect recitations. After criterion was reached, S was given a 5-min. rest interval. Following the rest, training continued to the point of 100% overlearning (double the number of trials up to, but not including, the three criterial trials) in order to insure a high degree of association between the words and colors.

Conditioning session.—After completion of the training session, a screen was placed on the table between S and E. The words were presented through a cut-out in the screen. A Garceau Clinical Dermohmeter was used to measure the skin resistance. Electrodes were placed on the palms and held firmly in place with adhesive tape. The UCS was a pure tone of 300 cps, at 80 db sensation level. This tone had been tested on S prior to the beginning of the training session in order to ascertain sensitivity of his GSR. The tone was sufficiently loud to elicit a GSR from all Ss.

Pre-conditioning levels of GSR were determined for each S by presenting each of the previously-learned words twice in random orders. A plain, white card, of the same dimensions as those on which the words were presented, was also presented without reinforcement at unequal intervals throughout all the conditioning and test trials in order to extinguish any response to the card as such.

Twelve reinforced trials were given, in which the CS (the N1/ word, dark extreme of scale) was paired with the UCS. The interval between presentation of CS and UCS was 3 sec., and an interval of approximately 10 sec. intervened between presentations of the CS-UCS pair. (This interval varied around 10 sec. due to variation in the time taken for the Dermohmeter needle to return to a zero reading after deflection.) The CS was then presented twice without the tone to test for conditioning, after which each of the other four words in the series was presented twice in two different random orders to test for generalization. The test stimuli were presented at the same rate as the CS-UCS pair during conditioning.

Association test.—After the conditioning session was completed and electrodes, earphones and screen removed, an association test was given in order to get an independent test of the establishment of a similarity scale. Each of the words was shown to *S* for 2 sec., and he was instructed to respond immediately with any *other* word from the training series which the given cue word suggested.

SUBJECTS

Twenty-one University of California freshmen served as Ss. They were all naive with respect to the purpose of the experiment, and none had any familiarity with the Turkish language.

Results

PAIRED-ASSOCIATE LEARNING

Mean trials to learn were computed on the basis of number of trials to and including the last trial on which an error was made. The three criterion trials were *not* counted as trials to learn. Mean trials to learn all words to the criterion of three perfect recitations was 13.02 ($SD =$ 7.17). There was a significant difference between words paired with different scale positions as indicated by an F of 11.57, $P < .01$. The smallest mean trials to learn were those yielded by words associated with N1/ and N9/. The Tukey gap test (15) was used to determine significant breaks between the means of trials to learn words paired with the different scale positions. The differences between the means of the words associated with the two colors representing the end positions of the brightness scale from those of the three middle positions was significant beyond the .01 level. Hence, the easiest words to learn were those paired with either end of the brightness scale. This finding cannot be attributed to the relative difficulty of the words per se, since they were rotated from *S* to *S* with respect to their color associates.

CONDITIONING

The scores used in this analysis were obtained from the Dermohmeter readings in the following way: immediately prior to the exposure of *S* to a word (CS and test words alike) the resistance level of *S* was recorded in ohms. The stimulus was then presented, and *S*'s GSR was measured in terms of the peak deflection from the initial resistance level. In accordance with the findings of Haggard (6) on selection of appropriate GSR measures for use in analysis of variance tests, log conductance changes were computed for each response.

TABLE 1

Analysis of Post-Conditioning Increments in GSR's (Log Conductance Changes)

MEASURE	MEAN DIFFERENCE (OVER PRE-COND. LEVEL)	σm	p
CS	1.24	.12	<.001
White card	.23	.17	<.20
CS minus white card	1.00	.13	<.001

From Phillips: Mediated verbal similarity as a determinant of the generalization of a conditioned GSR.

Table 1 gives the analysis of mean differences between pre- and post-conditioning levels of response to the CS word and to the neutral white card. The *t* of 9.97 for the CS demonstrates that a highly significant degree of conditioning was established. The mean difference of .23 between pre- and post-conditioning response levels to the white card does not reach significance. Hence, generalized GSR's to a neutral stimulus associated with the CS which may have developed during conditioning were not present to a significant degree during the test for generalization. Finally, the mean difference of 1.00 between the post-conditioning increments in GSR to CS and white card is significant beyond .01. From these findings it is concluded that the GSR was differentially elicited by the *word* used as CS, and did not constitute a generalized response to the total experimental situation.

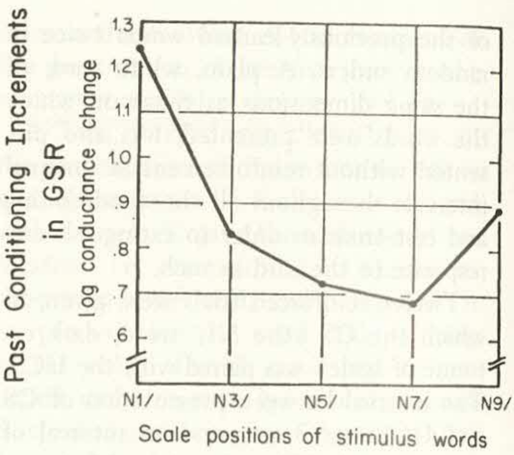

FIG. 1. Generalization of the response conditioned to the word previously associated with N1/. From Phillips: Mediated verbal similarity as a determinant of the generalization of a conditioned GSR.

The *pre-conditioning* GSR's to the five words show *no* significant variation as a function of scale position, ($F = 1.12$). However, as shown in Fig. 1, a trend appears in the generalized responses tested after conditioning of the word associated with N1/ (dark extreme of scale). Table 2 gives the results of the analysis of variance of differences between the pre-conditioning means and post-conditioning means for the five stimulus positions.

In order to analyze the shape of the generalization gradient plotted in Fig. 1, the method of orthogonal polynomials, described by Grant (5), was used. The over-all trend of the responses as a function of the mediated-similarity scale was significant beyond the .01 level. The negative linear, and positive quadratic components are each significant beyond the .01 level. Hence, the shape of the gradient is concave upward. Since p_2 is

TABLE 2

Trend Analysis of Post-Conditioning Increments in GSR's (Log Conductance Changes)

SOURCE	*df*	*MS*	ERROR TERM	*F*
A. Over-all trend	4	1.022	C	3.80*
a. linear	1	1.492	C_a	10.58*
b. quadratic	1	2.534	C_b	8.92*
c. cubic	1	.004	C_c	
d. quartic	1	.059	C_d	
B. Between individual means	20	1.957	C	
C. Between individual trends	80	.269		
a. linear	20	.141		
b. quadratic	20	.284		
c. cubic	20	.161		
d. quartic	20	.483		
D. Total	104			

* $P < .01$.

From Phillips: Mediated verbal similarity as a determinant of the generalization of a conditioned GSR.

positive, the significance of the quadratic component is heavily weighted by the generalized response to the word associated with the N9/ position.

ASSOCIATION TEST

If *S*s were to give their associations by choosing at random from the four other Turkish words, the probabilities of an adjacent association corresponding to each of the brightness-scale positions are: N1/, ¼; N3/, ½; N5/, ½; N7/, ½; N9/, ¼. The presentation of each of the five words to each *S* allows five opportunities per *S* for an adjacent association to occur, with probabilities as above. Hence, by chance, there should be an average of two adjacent associations per *S*.

However, if a scale of similarity has been established among the words as a result of the paired-associate training with the brightness dimension, one should expect significantly more than chance adjacent associations.

The mean of the obtained adjacent associations was 2.52 ($\sigma_m = .18$). Since the frequency distribution of adjacent associations was reasonably symmetrical, a one-tail *t* test was used to test the hypothesis that the obtained mean was not greater than 2. Since $t = 2.94$, ($P < .005$), it is concluded that *S*s responded to the cues with another word from an adjacent part of the scale significantly more than by chance. Hence, the association results indicate a similarity relationship among the five words selected from an unfamiliar language.

DISCUSSION

The results of this experiment have demonstrated: (a) the establishment of a scale of mediated verbal similarity; and (*b*) that a CR generalizes over the major portion of such an experimentally-produced dimension as a decreasing function of the differences from the CS.

According to Hull (9, p. 184f), a sensory continuum, such as the brightness dimension used in this experiment, should generate an "afferent generalization continuum" during conditioning. Further, the generalized reaction potential along a primary stimulus dimension should constitute a decreasing function of the distances from the CS. Hull's analysis of "secondary stimulus generalization" may be applied to the paired-associate training and subsequent conditioning of Ss in this experiment.

During the paired-associate training, when a Turkish word and a gray circle are presented to S, his response is a complex act; i.e., visual perception of several shades of gray, discrimination of the "correct" shade, pronunciation of the word, and simultaneously pointing to the discriminated shade. (For the sake of simplicity of exposition, the color-word direction of association will be omitted, but the same theoretical applications hold for both.) "Feed-back" stimuli then arise from this complex of overt and mediating responses made by the S to the stimuli on the primary sensory dimension. Hypothetically, such stimuli might function as representational or symbolic cues to which responses can be conditioned, such as those which might be conceived to arise from the judgmental act of choosing the correct shade of gray to pair with a given word.

One further assumption is needed: The hypothetical mediating responses made to any two neighboring points on the sensory scale are *more similar* than are those made to any two removed points. In more concrete terms, visual presentation of the word associated with N1/ will elicit, together with its overt responses (pronunciation of the word, pointing to the color) several mediating responses, (e.g., "black," "very dark," etc.) Similarly, presentation of the words associated with N3/, N5/, N7/, and N9/, will elicit different overt and mediating responses. However, the mediating responses elicited by the N3/ word will be more similar to those elicited by the N1/ word than will those elicited by, say, the N5/ word.

Osgood (11, p. 704) proposes such a "mechanism for degrees of similarity among mediation processes," and cites the lack of this assumption as a serious flaw in the theoretical formulation of Cofer and Foley (2). Moreover, this assumption may be justified in the present experiment by the conditions of training; i.e., the sensory stimuli consisted of a pre-established differential series.

Given these assumptions about what happens in the process of over-learning the paired associates during the training session, the results of the subsequent association test follow: The cue word will elicit mediating responses which are more similar to the mediating responses elicited by the word in the next scale position than to those of further removed words. These mediating responses will then produce stimuli which have become associated with the cue word; similar stimuli will have become associated with the next scale-position word and the resulting generalization gradients will overlap at a high level of reaction potential, as formulated by Hull (9, p. 195). Hence, the most probable word to be used as a response to any given cue will be the one associated with the next sensory-scale position.

Finally, when S's GSR is conditioned

to a word (in this case, the one associated with N1/), the mediating responses to this word also become conditioned. Since the mediating processes of the other words are differentially similar to those of N1/, the conditioned GSR will generalize to these words as a function of their similarity. The further removed the words are along the scale, the less similar to N1/ (the CS) will be their mediation processes. Hence on subsequent tests for generalization, the generalized GSR will be a decreasing function of the scale distance from N1/.

But how may we account for the rise in generalized GSR at the extreme opposite of the scale (see Fig. 1)? So far, the results of this experiment have paralleled Osgood's formulation of semantic generalization, according to which generalized reaction to similar mediators will be facilitated and generalized reaction to opposites will be inhibited (11, p. 708). However, he also presents evidence that responses to opposites (as frequently observed in free association tests) cannot be based upon semantic mediation processes, but are due to highly overlearned verbal habits (11, pp. 709–711). There is also evidence to support this view from the paired-associate training data of the present experiment, viz. the "anchoring effect" at the two extremes of the scale exhibited in significantly lower mean trials to learn words paired with N1/ and N9/. Since these two grays were often referred to as "black" and "white" by Ss, it may well be that they utilized a strong "black-white" response habit to delineate the scale during the paired-associate training. It may be concluded, then, that the generalized GSR received a "boost" at the end of the mediated scale by virtue of summation with an already stronger response at this point.

SUMMARY

An experiment was designed to establish a scale of verbal similarity and to test the generalization of a CR over this scale.

Five Turkish words were paired with five neutral Munsell colors constituting a brightness scale. Twenty-one Ss were trained to associate words and colors to a criterion of 100% over-learning beyond three perfect recitations of the pairs. The Ss were then conditioned to the word which had previously been learned as a paired associate to the dark extreme of the brightness scale. For conditioning, a loud, pure tone was paired with the stimulus word, and GSR was measured. The CS word and the other words in the series were then tested for GSR without the tone. After conditioning the words were presented randomly and first associations were recorded.

The results indicate that a mediated verbal similarity scale was established, and that the generalization gradient over the *major part* of this dimension was a decreasing function of the distance of the test stimulus from the CS.

These results were discussed in terms of (*a*) Hull's principles of primary and secondary generalization, and (*b*) Osgood's application of these principles to language behavior.

REFERENCES

1. Bass, M. J., & Hull, C. L. The irradiation of a tactile conditioned reflex in man. *J. comp. Psychol.*, 1934, **17,** 47–65.
2. Cofer, C. N., & Foley, J. P. Mediated generalization and the interpretation of verbal behavior: I. Prolegomena. *Psychol. Rev.*, 1942, **49,** 519–540.

3. Cofer, C. N., Janis, M., & Rowell, M. M. Mediated generalization and the interpretation of verbal behavior: III. Experimental study of antonym gradients. *J. exp. Psychol.*, 1943, **32,** 266–269.
4. Foley, J. P., & Cofer, C. N. Mediated generalization and the interpretation of verbal behavior: II. Experimental study of certain homophone and synonym gradients. *J. exp. Psychol.*, 1943, **32,** 168–175.
5. Grant, D. A. Analysis-of-variance tests in the analysis and comparison of curves. *Psychol. Bull.*, 1956, **53,** 141–154.
6. Haggard, E. A. On the application of analysis of variance to GSR data: I. The selection of an appropriate measure. *J. exp. Psychol.*, 1949, **39,** 378–392.
7. Hovland, C. I. The generalization of conditioned responses: I. The sensory generalization of conditioned responses with varying frequencies of tone. *J. gen. Psychol.*, 1937, **17,** 125–128.
8. Hovland, C. I. The generalization of conditioned responses: II. The sensory generalization of conditioned responses with varying intensities of tone. *J. genet. Psychol.*, 1937, **51,** 279–291.
9. Hull, C. L. *Principles of behavior.* New York: Appleton-Century-Crofts, 1943.
10. Nickerson, D., & Newhall, S. M. A psychological color solid. *J. Opt. Soc. Amer.*, 1943, **33,** 419–422.
11. Osgood, C. E. *Method and theory in experimental psychology.* New York: Oxford Univer. Press, 1953.
12. Razran, G. H. S. A quantitative study of meaning by a conditioned salivary technique (semantic conditioning). *Science*, 1939, **90,** 89–90.
13. Riess, B. F. Semantic conditioning involving the galvanic skin reflex. *J. exp. Psychol.*, 1940, **26,** 238–240.
14. Solomon, R. L., & Postman, L. Frequency of usage as a determinant of recognition thresholds for words. *J. exp. Psychol.*, 1952, **43,** 195–201.
15. Tukey, J. W. Comparing individual means in the analysis of variance. *Biometrics*, 1949, **5,** 99–114.

17.

The Mediation Hypothesis*

Charles E. Osgood

. . . Whereas Morris[1] links sign and object through partial identity of object-produced and disposition-*produced* behavior, we shall link sign and object through partial identity of the 'disposition' *itself* with the behavior elicited by the object. Words represent things because they produce some replica of the actual behavior toward these things. This is the crucial identification, the mechanism that ties signs to particular stimulus-objects and not to others. Stating the proposition formally, we may say: *a pattern of stimulation which is not the object is a sign of the object if it evokes in an organism a mediating reaction, this* (a) *being some fractional part of the total behavior elicited by the object and* (b) *producing distinctive self-stimulation that mediates responses which would not occur without the previous association of nonobject and object patterns of stimulation.* All of these limiting conditions seem necessary. The mediation process must include part of the same behavior made to the object if the sign is to have its representing property. What we have done here, in a sense, is to make explicit what may be implicit in Morris's term "disposition." The last stipulation adds the learning requirement lacking in Morris's formulation. The response of warrior-termites to pounding on the tunnel floor is ruled out because it does not depend upon previous association of pounding with a breach in the nest. Notice, however, that there is no requirement here that the overt responses to the sign be in any way related to those made to the object; this is in direct contrast to Morris's position.

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* From C. E. Osgood, The mediation hypothesis, in *Method and Theory in Experimental Psychology*, New York: Oxford University Press, 1953, pp. 695–698. Reprinted by permission of the author and the Oxford University Press.

[1] C. W. Morris. *Signs, language, and behavior.* New York: Prentice-Hall, 1946.

This conception of the sign-process is not concocted solely to meet the needs of semantics; it is the application of a general theory of learning to this particular class of phenomena. The mediation theory has been described in detail in an earlier chapter. At this point we shall be content to trace and illustrate the development of certain sign-processes as they apply to the problem of meaning. Paradigm *A* in Fig. 1 gives an abbreviated symbolic account of the development of a *sign* ($\boxed{S}$) via direct association with the stimulus-object signified. Paradigm *B* gives a similar account, necessarily somewhat more elaborate, of the development of an *assign* ($/S/$), which achieves its meaning indirectly through association with other signs rather than through direct association with stimulus-objects.

As an illustration of a largely *connotative sign* we may use the word SPIDER. This has special reference to the writer, who as a 9-year-old was badly frightened by these stimulus-objects—his tent-mates at a boys' camp, in ordinary youthful callousness, told him they had put a nest of large gray spiders in his bunk, and he lay awake all night awaiting the first crawly contact! The stimulus-object (S), the actual visual pattern of hairy-legged insect body, elicits a pattern of behavior (R_T), *which in this case includes a heavy loading of autonomic "fear" activity.* Through short circuiting, "detachable" portions of this total behavior to the spider-object (particularly "anxiety") become conditioned to the sign, the word SPIDER. With repetitions of the sign-process, the magnitude of the representational mediation process becomes reduced to some minimally effortful and minimally interfering replica—but still includes the release of those autonomic reactions which literally confer the unpleasant, connotative meaning of threat upon this word. This mediating reaction (r_m) produces a distinctive pattern of self-stimulation (s_m) which can elicit a variety of overt behaviors (R_X)—shivering and saying "ugh!", running out of a room when someone says, "There's a spider in here." Another interesting phenomenon may be observed here: the overt behavior elicited by a sign may gradually operate to change its meaning, by exactly the same short-circuiting mechanism. In the present case, the writer, in his teens, deliberately tried

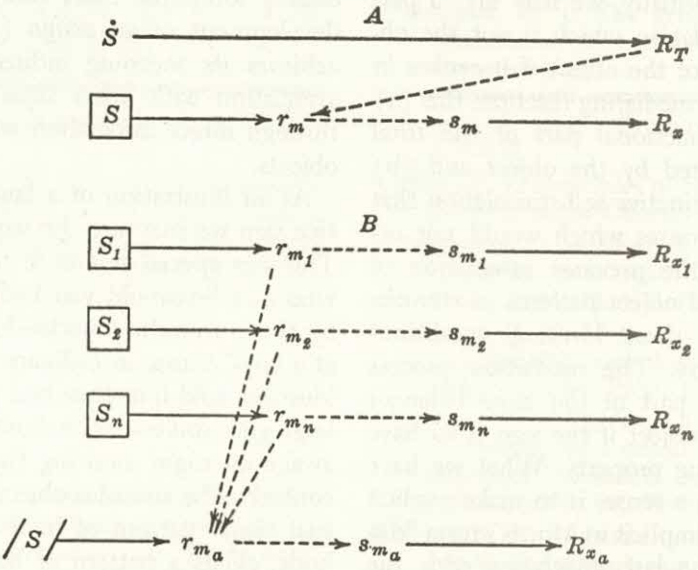

FIG. 1. ***A*. Development of a *sign*. A minimal but distinctive portion of the total behavior (R_T) originally elicited by an object (S) comes to be elicited by another pattern of stimulation ($\boxed{S}$) as a representational mediation process (r_m), the self-stimulation (s_m) from which mediates various instrumental sequences (R_x). This representational mediation process is the meaning of the sign. *B*. Development of an *assign*. Portions of the representational behaviors ($r_{m_1} - r_{m_n}$) associated with a set of signs ($S_1 - S_n$) transfer to a new pattern of stimulation, the assign (/*S*/), as a "distilled" representational process (r_{m_a}), which becomes the meaning of this assign. From Osgood: The mediation hypothesis.**

manipulating the spider-object, first at the end of a long stick and later even by holding it with his hand by its own strand. This repeated manipulatory behavior gradually diluted the "anxiety" meaning of the sign.

The word HAMMER will serve as an example of a largely *denotative sign*. The stimulus-object, a heavy thing having certain visual characteristics and certain tactual and proprioceptive effects, elicits in the young child, usually under instructions or imitation of some adult, a total pattern of behavior, including grasping and pounding movements. According to the mediation hypothesis, anticipatory portions of this behavior become short-circuited to the sign HAMMER. The process of reduction is especially important in the case of denotative signs—obviously, overt movements of the hands will interfere with other on-going instrumental behaviors and therefore tend to be extinguished. A young child, however, may actually be observed to clench his hand and move it up and down when asked for "hammer."

Just what the representational processes may be that ultimately become associated with denotative signs in adult humans is entirely unknown. We have been treating mediation processes as *if* they involved actual (though minimal) muscular and glandular reactions, i.e. as if the Jacobson and Max peripheral theory of consciousness were valid. It is convenient to think of it this way, and hypotheses of testable nature can be generated—but the mediation notion does not *require* that mediators be peripheral. If we keep in mind that the representational mediation process is a hypothetical construct, there is little danger in this approach; it could be entirely cortical without invalidating behavioral implications.

A very large proportion of the verbal signs used in communication are what we have termed *assigns*—their meaning is literally "assigned" to them via association, not with the objects represented but with other *signs*. Consider for example the word ZEBRA: This word is probably understood by most 5-year-olds, yet few of them have ever reacted in any way to the object itself. They have seen pictures of these animals in children's books (symbols); they have been told that zebras have stripes (signs), run like horses (sign), and are usually found wild (sign). These previously established signs (or assigns) elicit certain meaningful reactions, and since the new assign is temporally contiguous with these reactions, it also tends to become conditioned to them. To the extent that an assign is associated with many and varied signs (e.g. the class term, ANIMAL), its ultimate mediation activity would presumably be rather hybrid in nature—we know very little about this aspect of concept formation.

This analysis provides justification for a recent educational innovation, phonetic reading. The stimulus patterns that initially become signs of objects are generally auditory in character, since the child learns its basic vocabulary in the informal contexts of spoken language. When he starts learning to read, the "little black bugs" on the printed page are definitely *assigns;* these visual patterns are seldom directly associated with the objects signified, but rather with auditory signs (created by the child and teacher as they verbalize) and occasional visual symbols (pictorial representations of objects). Obviously, then, the more quickly the child can learn to make the right sound for the visual stimulus, the more quickly these new, visual assigns will acquire significance for him. The child already has meanings for "house," "dog," and even "typewriter" as *heard* stimulus patterns, but these mediating processes must be assigned to *seen* stimulus patterns. Our stereotyped notions of social reality are similarly derived. An "alien" is not something directly contacted with the senses. This label has acquired its unsavory significance through association with assigns which have themselves only a mediate connection with objects and experiences. "We don't want any enemy ALIENS poisoning our country." "That troublemaker is an ALIEN and ought to be shipped back where he came from." This class of signs could appropriately be termed *sign-assigns* (e.g. signs-of-assigns), they are that far removed from direct contact with the objects they are supposed to represent.

18.

The Psychologist Looks at Language*[1]

O. Hobart Mowrer[2]

I. Signs and Sentences

. . . It is certainly a common-place observation that small children, well before they start speaking in formal sentences, communicate quite effectively—though, as we shall see, with definite limitations—by means of single words. And even at the adult level, we often make single words function as full sentences, in what Skinner (69) has called "mands," i.e., demands, commands, exclamations, etc. But if we look closely at these so-called one-word sentences, we discover an interesting characteristic, namely that they always, or at least commonly, *imply* something else and thus *function*, in a restricted way, as a two-sign complex or true sentence. "Mands," it seems, always refer to, or imply, some thing or person which is physically present at the moment. Thus, if a baby says, "Bottle," it implies, "*I* want bottle"; and if an adult cries, "Stop," he implies, "Discontinue what you are now doing." Or, . . . the "Ouch" which the primitive man (or woman) uttered as a child was about to pick up a bee implied the bee and said, in effect, "Take care! *That object* is dangerous, will cause—pain." We may say, therefore, that although a single word or phrase can tell us something (and thus function as language) with respect to *something physically present*, it cannot tell us anything about what Hull has aptly referred to as "the not here and the not now" (28, p. 524). To say anything about a physically or temporally remote thing, event, or person we must represent it symbolically—there is, apparently, no other option; and this involves a *second* sign, or term, to which conventially—and probably for very sound psychological reasons (see Sections II and III)—we give first place in the two-sign sequence. Thus, as Stewart so insightfully observes, language comes into its own only with the development of the "noun-idea," i.e., when sentences have "sign" subjects as opposed to "thing" subjects. And as we shall see in a later section, this is a feat which no infrahuman organism seems to have achieved, and one which it takes even the human organism a little while to get the hang of.

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* From O. H. Mowrer, The psychologist looks at language, *Amer. Psychol.*, **9**, 660–694 (1954). Reprinted by permission of the author and the American Psychological Association.

[1] Presented, in abridged form, as the presidential address at the sixty-second annual convention of the American Psychological Association.

[2] The list of references at the end of this paper very inadequately indicates the writer's indebtedness to others. Besides those specifically mentioned, various other persons have given generously of their knowledge and critical assistance, in conversation and through correspondence. The writer warmly thanks colleagues and students both in his own department and elsewhere for their helpfulness. Special thanks are due to Dr. Charles E. Osgood, Mr. William G. Perry, Jr., Dr. Fillmore H. Sanford, and Dr. Laurance F. Shaffer for reading and very usefully criticizing a preliminary draft of this paper.

In summary of our inquiry thus far, we may say, then, that the transition from the use of single signs to multisigns or language proper is, in some ways, insignificant but in other ways truly momentous: It enables us to go from the concrete to the abstract, from the here-and-now to the "not here, not now." Our next major task is to clarify and expand this assumption and to indicate in more detail just how the grammatical unit or complex which we call the sentence works.[9]

II. What Do Sentences Do?

In the preceding discussion we have asked, and in at least a preliminary way answered, the question: What is the *nature* of a sentence? We have tried, that is to say, to determine what sentences, scientifically considered, are. In the present section an attempt will be made to discover what sentences *do*, i.e., how they *work*, psychologically speaking.

There is a very widespread assumption, which we will later have occasion to question, that in the process of spoken or written communication we, somehow, transfer meanings from mind to mind. To communicate, it is suggested, is to make something common, shared; and this something is meaning, understanding, thought, knowledge, ideas, information. One writer puts the matter this way. He says that language, broadly speaking, is characterized by a "transfer of meaning." It is the device "by which men have conveyed significant messages to one another since the dawn of history." "Meaning may be transferred by devices that have nothing to do either with the spoken language or with its written counterpart, and this basic proposition few will be so hardy as to deny" (58, p. 10).

Another writer says:

> When the day arrived on which one person could make such movements, gestures, or grimaces as would lead another person to avoid or to accept an object, that is to say, when a meaning could be transferred to one mind from another, language was created (24, pp. 207–208).

And yet another says:

> The philosophy of language, we may then say, to begin with, is concerned with *the evaluation of language as a bearer of meanings, as a medium of communication and as a sign or symbol of reality* (81, p. 37).

And to this the same writer later adds:

> On the question as to what linguistic fact is not, linguists are in general agreed. They are also agreed upon what it is that constitutes positively linguistic fact. The *sine qua non* of language is precisely the *meaning* of which the sounds, the motor processes and tactual sensations, are the bearers (p. 66).

The first of the writers just cited is a linguist, the second a psychologist, and the third a philosopher. We thus see how widely accepted is the notion that the basic function of language is to *transfer* or bear meanings from person to person, from mind to mind.[10]

It is not hard to understand how this conception of language has arisen; and, as we shall see later, there is a certain limited sense in which it is undoubtedly correct. But in another, perhaps more basic sense, this notion seems to be wide of the mark and to have been a barrier to the development of a psychology of language with real "power."

Let us explore now, instead, the proposition that in communication we are not transferring meanings from person to person so much as we are transferring meanings *from sign to sign* within a given person, within a single mind. Said a little differently, the suggestion is that in order for us to communicate effectively with another person, he must already *have* the meanings with which we shall be dealing and that in the communicative act we are, for the most part, merely changing the signs to which particular meanings are attached, merely shifting or transferring meanings from one sign to another. One person, by the use of appropriate words or other signs, can *arouse*, or "call up," particular meanings in the mind of another person; but he does not transfer or implant them there. The communicative act, in its most salient and significant aspect, lies rather in the combination, juxtaposition, or association of the meanings thus aroused *in novel, "informative" ways.*

A rudimentary sentence will illustrate this notion. Let us assume that John is telling Charles that: *Tom is a thief*. It is clear, is it not, that for the intended effect to be produced by this sentence, Charles must already know Tom and must know about thieves and thievery. In other words, Charles must already have meanings attached to the words, *Tom* and *thief*. What, then, is the function of the sentence, "Tom is a thief"? Most simply and most basically, it appears to be this. "Thief" is a sort of "unconditioned stimulus"—we shall later want to qualify this term, but for the moment it will suffice—a sort of "unconditioned stimulus" which can be depended upon to call forth an internal reaction which can be translated into, or defined by, the phrase, "a person who cannot be trusted," one who "takes things, steals." When, therefore, we put the word, or sign, "Tom" in front of the sign "thief," as shown in Fig. 1, we create a situation from which we, as psychologists, can predict a fairly definite result.[13] On the basis of the familiar principle of conditioning, we would expect that some of the reaction evoked by the second sign, "thief," would get shifted to the first sign, "Tom," so that Charles, the hearer of the sentence, would thereafter respond to the word, "Tom," *somewhat as he had previously responded to the word, "thief."* . . .

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[10] The three quotations cited are from books published, respectively, in 1949, 1924, and 1939. In Greenough and Kittredge's book, *Words and Their Ways in English Speech*, published in 1906, we find the same general thesis formulated thus: "Language is the expression of thought by means of words" (23, p. 2). And even in Fries's otherwise very adventurous book, *The Structure of English: An Introduction to the Construction of English Sentences*, published in 1952, we find the author saying that he does not "deny that the chief business of language is to communicate meanings of various kinds" (22, p. 8).

[13] In the above analysis the copula and indefinite article are omitted on the assumption that, in a present indicative sentence, they are really unessential. Support for this position is provided by the following excerpts from a recent letter from Professor Gregory Razran. He says: "The Russian equivalent of the English, 'I am a thief,' is 'Ya Vor.' The copula is always omitted in modern Russian in the present indicative, but is not omitted in Czech and Polish. The copula was not omitted in Old Slavic. Yet it would be incorrect to attribute such omissions to modern de-

Although the notion that the essence of language involves predication, i.e., the temporal conjunction of something called a *subject* with something called a *predicate*, is ancient and widespread,[14] there has recently been considerable tendency to replace it with the view that single words and sentences do not differ basically. In their book, *The Meaning of Meaning* (54), published in 1923, Ogden and Richards, while accepting the hypothesis that words *arouse* but do not "convey" or "bear" meanings,[15] nevertheless take the position that a sentence is just a complex sign. They say:

> Thus the reference of "larks sing," since it has two components, will differ from that of "larks" just as do "soaring larks" or "lark

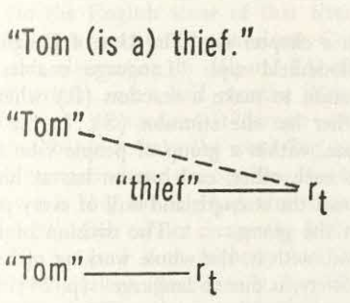

FIG. 1. Diagram illustrating how the sentence, "Tom is a thief," can be recast in the vernacular of conditioning theory. From Mowrer: The psychologist looks at language.

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velopments, since such copulas are also absent in ancient Hebrew. Moreover, . . . such copulas may also be omitted in Latin and Sanskrit (one may say in Latin, 'Ego fur sum,' as well as, for emphasis, 'Ego fur.'). As far as I know, Slavic languages have neither a definite nor an indefinite article, while Hebrew has a definite but not an indefinite article. The indefinite article in Teutonic and Romance languages seems to have developed from 'one,' as notice their identity in German, French, Spanish, and Italian, and, I believe, also in Old English. However, there is the differentiation of 'a' and 'an' from 'one' in modern English."

[14] "Thus Sapir is voicing a view very prevalent among philologists, when he writes, 'There must be something to talk about and something must be said about this subject of discourse once it is selected. . . . The subject of discourse is a noun. . . . No language wholly fails to distinguish noun and verb' (54, p. 260). "For centuries it has been insisted that, for completeness, every sentence must have a word representing a person, place, or thing, and also a word 'asserting' or 'saying something' about that person, place or thing. There must be a 'subject' and a 'predicate'" (22, p. 14).

[15] Malinowski wrote an essay entitled "The Problem of Meaning in Primitive Languages" which Ogden and Richards published as part of their book and which Osgood (55), in discussing the notion that words "carry" meanings from person to person, cites as follows: "Malinowski aptly dubbed this naive conception the 'bucket theory' of meaning—words like little buckets are assumed to pick up their loads of meaning in one mind, carry them across intervening space, and dump them in another mind. 'This attitude in which the word is regarded as a real entity, containing its meaning as a Soul-box contains the spiritual part of a person or thing, is shown to be derived from the primitive, magical uses of language and to reach right into the most important and influential systems of metaphysics. Meaning, the real "essence" of a word, achieves thus Real Existence in Plato's realm of Ideas . . .'" (41, p. 680).

> pie," being also dual references. This difference is therefore unessential, though most complex references do in fact use the propositional form (p. 259).

In his *Signs, Language, and Behavior* (47), Morris says:

> The fifth criterion requires that language signs be combinable with each other in certain ways and not in others, and that these combinations form a complex sign. . . . Hull has suggested that such combinations are to be explained in terms of simultaneous and temporal stimulus patterning, since ". . . In reading, each letter is a complex visual pattern, each word is a complex pattern of these letter patterns, and each sentence is a temporally patterned sequence of printed word patterns" (p. 58).

And more recent and more explicit still is the following formulation by Dollard and Miller (17):

> As has already been pointed out, a person can learn to respond to specific combinations of stimuli or relationships among them and to make different responses to the same cues in different contexts. This is called patterning. A person's responses to the words that he hears someone else speak obviously involve patterning. Thus a parent will respond quite differently to the following two reports containing the same words in different sequences: "Jim hit Mary" and "Mary hit Jim." This is an exceedingly simple example. Although scarcely a beginning has been made toward the study of language from the point of view of learning theory, it is obvious that man's great innate capacity and rigorous social training have produced marvelously intricate and subtle patterning in his responses to spoken language (p. 100).[16]

The notion under examination in the present paper is different. It is that the sentence is, preeminently, a *conditioning device*, and that its chief effect is to produce new associations, new learning, just as any other paired presentation of stimuli may do. This position is congruent with the traditional notion that predication is the essence of language and may indicate, perhaps more precisely than purely linguistic research has done, the basic nature of this phenomenon.[17]

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[16] The notion that language is just a form of interpersonal stimulation and response is undoubtedly a product of the era of behaviorism; and it achieved one of its earliest, clearest, and most influential formulations in the writings of Bloomfield (6). In a chapter on "The Use of Language," Bloomfield says: "Language enables one person to make a reaction (R) when another has the stimulus (S). In the ideal case, within a group of people who speak to each other, each person has at his disposal the strength and skill of every person in the group. . . . The division of labor, and, with it, the whole working of human society, is due to language" (p. 24). Thus a person with a need or wish may respond either by trying to deal with the need himself ("practical action"), or he may try to stimulate someone else to do it for him ("linguistic substitute reaction"). The latter situation Bloomfield represents as follows: S (first person's problem or need) → r (speech reactions) → S (speech as heard by another person) → R (the instrumental response or work done for the first person by the other person). Here the recipient of the speech stimulus is what Courtney (13), in discussing the child-mother relationship, has called a "mediator" (not to be confused with "mediating response," Sections III and IV). While widely accepted (see Fries, 22, ch. III), this conception of language seems greatly oversimplified: it ignores the phenomenon of predication (making a sentence basically the same as a stimulus) and bypasses the whole problem of meaning, knowledge, information, i.e., mediate as opposed to immediate behavior, predispositions to action as opposed to direct response.

[17] In thus emphasizing predication, the writer does not exclude the possibility that

This notion is presented here in a frankly exploratory manner, as a hypothesis which others are invited to consider and test against the prevailing concepts and facts of their particular specialties. The remainder of this paper will be concerned with an examination and elaboration, both theoretical and empirical, of this hypothesis from a psychological point of view, with special reference to learning theory.[17a]

III. The Concept of Mediation

Perhaps the most generally accepted criterion as to whether a sentence has or

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word combinations not involving predication (in the English sense of that term) may function as sentence equivalents. Consider this observation by Wyatt: "At the age of sixteen and a half months [Nana] said *bighorsy*, pronouncing it like one word. She then began to take the word 'big' out of the compound and to combine it with other words: *big hat, big bag*, and so on" (88, p. 29). One cannot escape the feeling that *big hat* and even *bighorsy* may be roughly equivalent, functionally, to "The hat is big," "The horse is big." Wyatt further observes that "Sapir has proved that in all known languages juxtaposition is the simplest, most economical method of binding words together and of bringing them into some relation to each other, without attempting an inherent modification of these words. 'The very process of juxtaposing concept to concept, symbol to symbol, forces some kind of relational *feeling*, if nothing else, upon us. Words and elements, once they are listed in a certain order, tend not only to establish some kind of relation among themselves but are attracted to each other in greater or in less degree'" (88, p. 31). Perhaps it should be said that in the present paper we are examining the psychological implications of *one form* of word "juxtaposition," namely the propositional or subject-predicate form. Whether other forms of juxtaposition involve different psychological principles is at present an open question (see Section X).

[17a] Since this paper went to press, the writer has discovered a very closely related, but unelaborated, conception of the communicative process. In a recent paper by Carpenter (10a), entitled "A theoretical orientation for instructional film research," we find brief reference to the "releasor-organizer hypothesis," which is "that the signals, signs, and symbols of sound motion pictures function principally as releasors and organizers of meanings and responses in human subjects" (p. 42). The releasing function of signs is said to be "both dependent (or interdependent) on the stimulation and on the activated brain processes ('engrams') of the experiencing subjects. Thus, it may be reasoned that the functions of signals, signs, and symbols is to *release responses in subjects*. . . . Signs and symbols *do not transmit* meanings; they release meaning when and only when the subjects respond. The characteristics of these responses relate closely to personal life history differences" (pp. 42–43). The author continues: "The releasor concept of signs and symbols must be supplemented by the related *organizer* concept. Previously learned 'engrams' may be modified by new stimulation, and even new *related* elements may be 'imprinted.' New relationships may be shown, and old responses modified by film mediated stimulation. The results are conceived to consist principally of the *re-organization* of previously learned neural-organic patterns which intervene between film stimulation and the subsequent actions or reactions of the individual" (p. 43). The notion that signs release, or arouse, meanings *in* rather than "bear" them *to* another individual, as stated by Carpenter, is identical with the position taken in the present analysis. The "organizer" conception, while stated in somewhat different terms, is also believed to be essentially congruent, at a relatively abstract level, with the theory of sentence function as here developed. Whether the notion of "reorganization" can, without injustice, be analyzed in terms of conditioning and mediation (see next section) or whether more holistic principles are required (see Section X) is uncertain.

has not done its work is this: If, as a result of hearing or reading a sentence, an individual's behavior, on some future occasion, with respect to some person, thing, or event not present when the sentence occurred, is different from what it would otherwise have been, then that sentence may be said to have been "understood" and to have functioned effectively. If, for example, John tells Charles, in the absence of Tom, that Tom is a thief and if, when Charles subsequently encounters Tom, he reacts toward him with distrust and apprehension, communication has clearly taken place.

But this criterion of linguistic action poses an interesting problem for the behavioral scientist. As psychologists, we are all quite familiar with situations in which an organism learns, or is taught, to react to a sign more or less as if it were the thing or event signified. In the vernacular of the conditioning laboratory, the organism, after conjoint exposure to the conditioned stimulus and the unconditioned stimulus, reacts to the CS somewhat as if it were the UnCS. Or, as we may equivalently say, the meaning of the UnCS "moves forward" and becomes anticipatory.

This phenomenon seems to occur in language, true enough, as when the predicate meaning of a sentence "moves forward" and gets connected to the sentence subject. But in language something else, of a different nature, is also involved. This is the remarkable, and indeed somewhat paradoxical, phenomenon of an organism, after exposure to a sentence, reacting to some thing, event, or person as if it were the corresponding sign or symbol which was the subject of the sentence. In other words, the new meaning attached, by means of predication, to the sign constituting the subject of a sentence has a tendency to shift or transfer "back," so to say, to the thing, event, or person which the subject of the sentence represents, or "stands for." This is a phenomenon to which comparatively little attention has been given but which can be satisfactorily accounted for on the basis of well-known principles.

Let us note, first of all, that what we are positing here is something quite different from so-called backward conditioning. This is fortunate, for backward conditioning is a questionable, controversial type of event, whereas the phenomenon with which we are here concerned seems, as phenomenon, not to be in the least questionable. We are, however, in need of a precise explanation. Let us begin by making a more detailed diagrammatic analysis of the sentence, "Tom is a thief." In Fig. 1 we have already seen how the familiar principle of conditioning can explain the fact that some part of the reaction evoked by the word "thief" gets connected to the word "Tom," but we have not as yet said anything about the sequence of events whereby "Tom" and "thief" originally acquired their meanings. As Fig. 2 shows, the word "Tom" acquired its meaning by being associated with, and occurring in the context of, Tom as a real person. Tom himself has elicited in John and Charles and others who have had first-hand contact with him a reaction which we can label, R_T, of which r_T is a component. And as a result of the paired presentation or concurrence of "Tom" the word and Tom the person, the component, or "detachable," reaction, r_T, gets shifted from the latter to the former.[18]

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[18] It may be helpful to think of the R_T reaction, mentioned above, and the so-called "detachable component," r_T, as

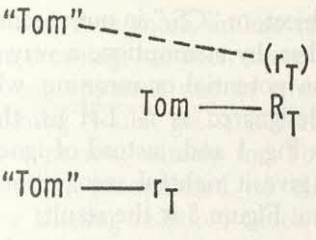

FIG. 2. Schematic indication of the way in which the word, "Tom," through the process of conditioning, comes to denote, mean, or imply a certain person, Tom. From Mowrer: The psychologist looks at language.

And similarly for the word, "thief." As indicated in Fig. 3, this word is likewise presumed to have acquired its distinctive meaning by having been used in the presence of, or to have been, as we say, "associated with," actual thieves. Therefore, when we make the sentence, "Tom (is a) thief," it is in no way surprising or incomprehensible that the r_t reaction gets shifted, as originally shown in Fig. 1, from the word, "thief," to the word, "Tom." This is seemingly a straightforward instance of second-order conditioning: By first-order conditioning some part of the total reaction elicited by real thieves gets shifted to the word, "thief," and by second-order conditioning of the type provided by the sentence, this same reaction, with some attenuation or weakening, gets

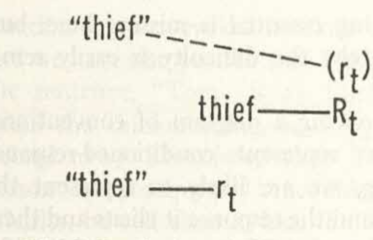

FIG. 3. Replication of Fig. 2 showing how the word, "thief," acquires its distinctive meaning. From Mowrer: The psychologist looks at language.

further transferred or shifted to the word "Tom."

Our analysis thus far is, however, either incomplete or faulty, for if language worked precisely as suggested, it would pretty obviously not do what we want it to do and what, a good deal of the time, it manifestly does. If language worked as thus far indicated, the sentence, "Tom is a thief," would serve merely to *change the meaning of "Tom,"* so that when Charles, as the recipient of this sentence, subsequently heard this word, it would remind him less or perhaps not at all of Tom but rather of thieves. It would, in other words, become just a synonym for the word, "thief," and we would have simply an instance of *reconditioning*, a procedure whereby the noise, "Tom," would lose its old meaning and acquire a new, different one. This type of conditioning, or reconditioning, would, pretty obviously, not serve our communicative needs at all and would soon lead to utter chaos.[19] Clearly,

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analogous, respectively, to the total reaction produced by an electric shock in a rat and the reaction produced by a stimulus which is merely a sign of shock. Shock produces sensations of pain and also fear; but it is only the latter which gets conditioned, or "detached," and occurs anticipatorily, to a mere signal or sign of shock.

[19] Some premonition of what this might be like, on a general scale, is suggested by the experience which many persons report of sometimes repeating two or three times (either to themselves or aloud) some word whose meaning is not very well established

something essential is missing here; but, fortunately, the difficulty is easily remedied.

In drawing a diagram of conventional type to represent conditioned-response learning, we are likely to represent the UnCS and the response it elicits and then, in adding the CS, to say something like this: "This is an originally neutral stimulus. Oh, to be sure, it probably evokes some reaction, but for our purposes it is not important." Thus we end with a drawing something like that shown in Fig. 4.

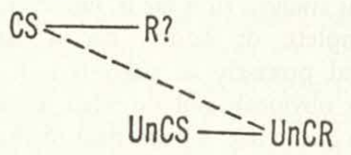

FIG. 4. Conventional conditioning diagram, indicating the common neglect of the reaction originally produced by the conditioned stimulus. From Mowrer: The psychologist looks at language.

But if we are to succeed in making conditioning theory account for the basic facts of language, we must manifestly proceed a little differently at this point. As already indicated, particularly in Fig. 2, the subject, or "CS," in our specimen sentence has, by assumption, a very definite reaction potential or meaning, which we have designated as r_T. Let us, therefore, redraw Fig. 1 and, instead of ignoring r_T, let us give it rightful recognition in the diagram. Figure 5 is the result.

Assuming now, as we reasonably may, that the "Tom"——r_T connection is a relatively stable one, we will expect the conditioning outcome shown at the bottom of Fig. 5. Instead of r_t, the thief-meaning, getting connected *directly* to the word, "Tom," and more or less replacing the r_T reaction, we may infer that r_t will get conditioned rather to the reaction—or, more accurately, to the stimuli or sensations produced by the reaction—which the word "Tom" produces, namely r_T. This internal reaction, or meaning, thus becomes what Lumsdaine (38), Foley and Cofer (20), Osgood (56), and others have recently called a *mediating response*, and its importance is indicated by the felicity with which it delivers us from the difficulties into which a too simple, too abbreviated analysis of language in terms of conditioning plunges us.

If our specimen sentence worked as Fig. 1 implies, i.e., if the thief-meaning, r_t, got conditioned directly to the word,

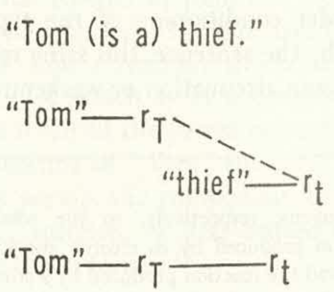

FIG. 5. Replication of Fig. 1, but with the mediating response, r_T, included rather than omitted. From Mowrer: The psychologist looks at language.

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and finding that the word "loses its meaning," more or less completely. The word becomes, so to say, "blank," a mere empty sound. The problem which language theory manifestly poses for us in this connection is that of determining how it is that a word, as the subject of a sentence, can take on some of the denotation, or at least connotation, of the predicate of the sentence and still retain its original meaning. (But see Section IV.)

"Tom," and thus more or less replaced the Tom-meaning, r_T, then there would be only one apparent way in which the thief-meaning could get transferred to Tom as a person, namely for Tom-the-person, when encountered, to elicit in Charles a *labeling reaction*, which would involve his saying, at least subvocally, the word, "Tom," which in turn would then elicit the thief-meaning, r_t (see Fig. 6). While this hypothesis is logically tenable and may in some cases correspond to reality, it has, as will be shown in the next section, rather limited applicability. Moreover, a different way of looking at the same problem is immediately available which seems much less restrictive.[20]

We have already posited (see Fig. 2) that the meaning reaction, r_T, which gets connected to the word, "Tom," is a component of R_T, which is the reaction or reaction complex evoked by Tom himself; and we have also posited (see Fig. 5) that the sentence, "Tom (is a) thief," will cause the thief-meaning, r_t, to get connected to r_T. Therefore, when Tom-the-person is subsequently encountered by Charles, he will elicit in him the R_T reaction, of which r_T is a part, which will in turn elicit the thief-meaning, r_t. Q.E.D. This mechanism for the occurrence of semantic generalization or meaning transfer from sign to thing is shown schematically in Fig. 7 and is characterized by relative simplicity yet also possesses, seemingly, considerable generality and explanatory vigor. In the next section we shall look for other than logical evidence to support such a notion.[21]

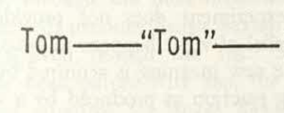

FIG. 6. A possible, but not entirely satisfactory, conception of how a meaning acquired by a word ("Tom") can get transferred to the thing or person (Tom) represented by the word. From Mowrer: The psychologist looks at language.

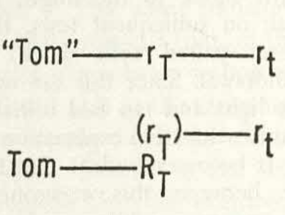

FIG. 7. Indication of how r_T, in the example given, functions as a "mediating response." Cf. Fig. 5 and Fig. 2. From Mowrer: The psychologist looks at language.

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[20] Dollard and Miller (17, see especially ch. VI) have developed in considerable detail the notion of response generalization and transfer (as well as discrimination) through "labeling." However, they agree that such generalization may occur on the basis of "labeling or other cue-producing responses" (p. 105). Thus they do not exclude as a possibility the mechanism which is to be emphasized in the following discussion.

[21] Interestingly enough, this hypothesis has at least verbal similarity to the "identical-elements" theory of "transfer of training" as advanced by Thorndike (77) and others. A mediating reaction, such as r_T in the above example, is an "identical element" in the reaction produced by both the word, "Tom," and the person, Tom. Therefore, if, by means of the Tom-is-a-thief sentence, we get a new meaning-reaction, r_t, conditioned to r_T as elicited by the word, "Tom," we will expect it to generalize to r_T as elicited (in the context of the total R_T) by the person, Tom.

IV. Verbal and Nonverbal Examples of Response Mediation

As Osgood has remarked, the concept of mediation is not devised "solely to meet the needs of semantics; it is the application of a general theory of learning to this particular class of phenomena" (55, p. 696). Two of the experiments which are most relevant in this connection have been concisely summarized by Osgood as follows:

> Fortunately [he says] there are cases in which the mediation process is specifiable with some accuracy. Shipley [68] paired a faint light with a sudden tap on the cheek, which elicited winking; then the tap was paired with shock to the finger, eliciting withdrawal; on subsequent tests, the light flash (never paired with shock) evoked finger withdrawal. Since this did not occur unless the light and tap had initially been paired, any sensitization explanation is ruled out. . . . It becomes evident that the only difference between this experiment and those on sensory conditioning lies in the specificity of the mediating reaction—here, the winking movement (55, pp. 461–462).

This experiment is schematized in Fig. 8 and provides a nice example of how it is that a response, in this case the eye blink, can, so to say, "carry" another response, finger flexion, from one stimulus (tap on cheek) to another (light) without the latter having ever been used either as a conditioned or an unconditioned stimulus for the elicitation of the flexion response. This, in essence, is the mechanism posited in the preceding section to explain how it is that, in a sentence, a meaning conditioned to another meaning, i.e., to the mediating response, can generalize or transfer back to the object represented by the sign that elicits the mediator or, more precisely, to the *response* elicited by that object.[22]

However, since the Shipley experiment was done without reference to the mediation hypothesis and with no particular attention being paid to the blink reaction in the second stage of conditioning, it is important to ask, as does Osgood:

> But did this mediating winking reaction actually occur? [By way of reply, this writer goes on to say:] Lumsdaine [38; cf. pp. 230 ff. in Hilgard and Marquis, 26] has repeated Shipley's experiment with detailed graphic recording. His records indicate that, in most cases the light *did* elicit a winking movement which was closely followed by finger withdrawal. There were some cases, however, in which the withdrawal reaction antedated the eyelid movement, and this suggests that the winking movement may be only an overt index of the actual mediation

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[22] It should be noted, however, that the Shipley experiment does not provide an exact parallel of what happens in language. There the new meaning is acquired by the mediating reaction as produced by a word (conditioned stimulus) and generalizes to the thing (unconditioned stimulus); whereas, in the Shipley experiment, the new response (finger flexion) is conditioned to the mediating reaction (blink) as produced by the tap (unconditioned stimulus) and generalizes to the light (conditioned stimulus). Experiments cited later in this section show that "semantic generalization" of conditioned reactions occurs from thing to cognate word as well as from word to thing. But ordinarily, in language, we are more concerned with the latter occurrence than with the former. For the Shipley paradigm to have been strictly parallel to this type of generalization, finger flexion should have been conditioned to blink as elicited by light (a conditioned stimulus) so that the flexion could have generalized to the tap (or unconditioned stimulus).

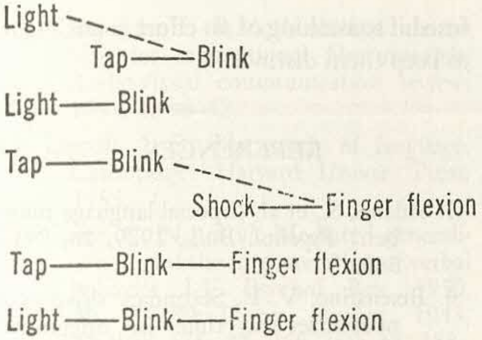

FIG. 8. An example of response mediation discovered, rather accidentally, by Shipley (68). The assumption is that in the second stage of conditioning (lines four and five), the finger flexion gets attached, not directly to the tap stimulus, but to the response (blink) produced by the tap (see next to last line). (More precisely said, the finger flexion gets conditioned to the proprioceptive and other stimuli produced by the blink—or to the central equivalents of the blink. See text.) And since light, as a result of the first stage of conditioning, is also capable of producing the blink reaction, it follows that the light, through the inter-mediation of the blink, will produce finger flexion (see last line), even though the light has itself never been paired with tap, the unconditioned stimulus for finger flexion. From Mowrer: The psychologist looks at language.

> process. This is what would be expected according to the mediation hypothesis: in the original training, the light (sign) was presumably becoming associated with the fractional anticipatory portions of the reaction to tap-on-cheek (stimulus-object), and it is this mediation process which is more or less faithfully indexed by the overt winking (55, p. 462).

Elsewhere in his book, Osgood (see also Cofer and collaborators [12]) cites a number of other instances of response mediation, reported mainly by Russian investigators, in which responses conditioned to words readily generalized to the objects they represent and in which responses conditioned to objects generalized to cognate words. Against the background of these findings, it is not surprising to discover, as Razran (61) has, that a salivary response conditioned to one word, e.g., "style," will readily generalize to another word, viz., "fashion," which is physically very different but which elicits much the same meaning or mediating reaction. In fact, this investigator found that considerably more generalization of conditioning (59% as opposed to 37%) occurred on the basis of similarity of meaning (synonyms) than on the basis of similarity of sight or sound (homophones, e.g., in the present instance, to a word like "stile"). That some transfer occurred on both bases suggests that, in the Razran experiment, the salivary response was conditioned not only to the meaning reaction produced by the word "style" but also, to some extent, directly to the word itself. To the extent that this occurred we may say that salivation replaced the meaning response previously attached to this word, i.e., its meaning was *changed*; but this was not the only, or even the main effect, since transfer on the basis of the mediation mechanism was greater.

No, the notion of response mediation—Hull (28) spoke of "pure stimulus acts," Hilgard and Marquis (26), of "intermediate responses"—is by no means invented "to meet the needs of semantics." It is a common and well-established phenomenon whose centrality in language can hardly be doubted and which apparently can alone explain, broadly yet simply, how it is that what we learn through sentences can generalize, or transfer, despite absence of any sensory similarity or continuum, both to other words of similar meaning and also to the realities thereby denoted.[23]

In concluding this section, it may be useful to emphasize a distinction which is implicit in the foregoing but which may have become somewhat obscured in the course of the discussion. We have seen, first of all, that the basic function of the subject-predicate unit which we call a sentence is to condition the predicate meaning so that it will later be connected to and elicited by the subject meaning. This we have referred to, somewhat elliptically, as a transfer of meaning from sign to sign, as opposed to mind to mind. And in the consideration of semantic generalization we have likewise spoken of transfer. What needs to be particularly noted here is that the kind of "transfer" involved in the two cases is different; in the first instance it involves transfer in the sense of *conditioning* and, in the second instance, in the sense of *generalization*. The two phenomena can be easily confused if something of an effort is not made to keep them distinct.[24]

REFERENCES

1. Adams, S., *et al.* (Special language number.) *Psychol. Bull.*, 1929, **26,** 241–340.

4. Bixenstine, V. E. Secondary drive as a neutralizer of time in integrative problem solving. Unpublished doctor's thesis, Univer. of Illinois, 1953.

6. Bloomfield, L. *Language*. New York: Holt, 1933.

7. Boder, D. P. The DRQ as a measure of tension in personal documents. Unpublished manuscript, Illinois Institute of Technology, 1951.

8. Bousfield, W. A., & Barclay, W. D. The application of Zipf's analysis of language to sequences of restrictive responses. *J. genet. Psychol.*, 1951, **44,** 253–260.

9. Bühler, Charlotte. *The first year of life*. New York: Day, 1930.

10. Bühler, K. *The mental development of the child*. New York: Harcourt, Brace, 1930.

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[23] A psychologist can hardly think about response mediation as it functions in language without also being reminded of at least some of the phenomena implied by the word "insight." In the published report of one of the first experiments in which response mediation was unequivocally demonstrated, the author, N. E. Miller (45), while making no reference to language, speaks repeatedly of "insight" and "foresight" (see also May, 43; Nygaard, 53; and Mowrer, 52, ch. 5 and 11). For a consideration of insight with special reference to "transfer of training," see Thompson (75, p. 165); see also the discussion of language and the syllogism, Section VIII. For experiments and theoretical discussions bearing on the problem of "latent learning" but which are also relevant to the concept of mediation, see Tolman and Gleitman (78) and Strain (72).

[24] It may be useful at this point to refer back to Fig. 8. There is a temptation to think of the experiment there represented as merely an instance of higher order conditioning. But it is something different. It involves "transfer" in the sense of generalization: because both tap-on-cheek and, after conditioning, light can be used to elicit the blink reaction, if finger flexion gets conditioned to the blink reaction as elicited by the tap, finger flexion will generalize to blink as elicited by light as well. Incidentally, we may add that if one takes the position that a sentence is a conditioning device, it is understandable why the reactions of a human subject, in a conditioning experiment, can often be dramatically altered by "instructions." They constitute a form of anterior conditioning, so that the subject is no longer "naive."

10a. Carpenter, C. R. A theoretical orientation for instructional film research. *Audio-visual communication review*, 1953, **1**, 38–52.

11. Carroll, J. B. *The study of language*. Cambridge: Harvard Univer. Press, 1953.

12. Cofer, C. N., *et al.* Mediated generalization and the interpretation of verbal behavior. I-V. *Psychol. Rev.*, 1950, **49**, 513–39; *J. exp. psychol.*, 1943, **32**, 168–175; **32**, 266–269; **33**, 188–200; **33**, 299–309.

13. Courtney, P. D. Identification and learning: a theoretical analysis. Unpublished doctor's dissertation, Harvard Univer., 1949.

15. DeLaguna, Grace. *Speech: its function and development*. New Haven: Yale Univer. Press, 1927.

17. Dollard, J., & Miller, N. E. *Personality and psychotherapy*. New York: McGraw-Hill, 1950.

18. Fairbanks, G. Systematic research in experimental phonetics: I. A theory of speech mechanism as a servosystem. *J. Speech Hearing Disorders*, 1954, **19**, 133–139.

20. Foley, J. P., Jr., & Cofer, C. N. Mediated generalization and the interpretation of verbal behavior: II. Experimental study of certain homophone and synonymous gradients. *J. exp. Psychol.*, 1943, **32**, 168–175.

21. Fowler, H. W. *A dictionary of modern English* usage. London: Clarendon Press, 1926.

22. Fries, C. C. *The structure of English—an introduction to the construction of English sentences*. New York: Harcourt, Brace, 1952.

23. Greenough, J. B., & Kittredge, G. L. *Words and their ways in English speech*. New York: Macmillan, 1906.

24. Griffith, C. R. *General introduction to psychology*. New York: Macmillan, 1924.

25. Grummon, D. L. An investigation into the use of grammatical and psychogrammatical categories of language for the study of personality and psychotherapy. Unpublished doctor's dissertation, Univer. of Chicago, 1950.

26. Hilgard, E. R., & Marquis, D. G. *Conditioning and learning*. New York: D. Appleton-Century, 1940.

27. Hollingworth, H. L. *Psychology, its facts and principles*. New York: D. Appleton, 1928.

28. Hull, C. L. Knowledge and purpose as habit mechanisms. *Psychol. Rev.*, 1930, **37**, 511–525.

30. Hunter, W. S. *Human behavior*. Chicago: Univer. of Chicago Press, 1928.

32. Johnson, W. Studies in language behavior. I. A program of research. *Psychol. Monogr.*, 1944, **56**, No. 2 (Whole No. 255) 1–15.

33. Judd, C. H. *Psychology—general introduction*. New York: Scribner's 1907.

36. Lewis, M. M. *Infant speech: a study of the beginnings of language*. New York: Humanities Press, 1951.

38. Lumsdaine, A. A. Conditioned eyelid responses as mediating generalized finger reaction. *Psychol. Bull.*, 1939, **36**, 650. (Abstract)

39. McCarthy, Dorothea. The language development of the preschool child. Minneapolis: Univer. of Minnesota Press, 1930. (*Institute of Child Welfare Monogr. Ser.*, No. 4.)

40. McCarthy, Dorothea. Language development in children. In L. Carmichael (Ed.), *Manual of Child psychology*. New York: Wiley, 1954. Pp. 492–630.

41. Malinowski, B. The problem of meaning in primitive languages. In C. K. Ogden & I. A. Richards, *The meaning of meaning*. Supplement I. New York: Harcourt, Brace, 1938.

42. Marx, M. A stimulus response analysis of the hoarding habit in the rat. *Psychol. Rev.*, 1950, **57**, 80–91.

43. May, M. A. Experimentally acquired drives. *J. exp. Psychol.*, 1948, **38**, 66–77.

44. Miller, G. A. *Language and communication*. New York: McGraw-Hill, 1951.

45. Miller, N. E. A reply to "Sign-gestalt or conditioned reflex?" *Psychol. Rev.*, 1935, **42,** 280–292.

47. Morris, C. *Signs, language, and behavior.* New York: Prentice-Hall, 1946.

48. Morris, C. W. Foundations of the theory of signs. *Int. Encycl. Unif. Sci.*, 1938, No. 1, 63–75.

49. Mowrer, O. H. *Learning theory and personality dynamics.* New York: Ronald, 1950.

51. Mowrer, O. H. Learning theory: historical review and reinterpretation. *Harv. educ. Rev.*, 1954, **24,** 37–58.

52. Mowrer, O. H., Palma, Florence, & Sanger, Marjorie D. Individual learning and "racial experience" in the rat, with special reference to vocalization. *J. genet. Psychol.*, 1948, **73,** 29–43.

53. Nygaard, J. Unpublished research. See Osgood (55).

54. Ogden, C. K., & Richards, I. A. *The meaning of meaning.* New York: Harcourt, Brace, 1923.

55. Osgood, C. E. *Method and theory in experimental psychology.* New York: Oxford Univer. Press, 1953.

56. Osgood, C. E., & Suci, G. J. Factor analysis of meaning. *J. exp. Psychol.*, in press.

57. Osgood, C. E., & Tannenbaum, P. H. The principle of congruity in the prediction of attitude change. *Psychol. Rev.*, in press.

58. Pei, M. *The story of language.* New York: J. B. Lippincott, 1949.

60. Pronko, N. H. Language and psycholinguistics: a review. *Psychol. Bull.*, 1946, **43,** 189–232.

61. Razran, G. H. S. A quantitative study of meaning by a conditioned salivary technique (semantic conditioning). *Science, N.S.*, 1939, **90,** 89–90.

62. Rexroad, C. N. *General psychology.* New York: Macmillan, 1929.

63. Roback, A. A. *Destiny and motivation in language.* Cambridge, Mass.: Sci-Art Press, 1954.

64. Sanford, F. H. *Speech and personality. Psychol. Bull.*, 1942, **39,** 811–845.

67. Shannon, C. E., & Weaver, W. *The mathematical theory of communication.* Urbana: Univer. of Illinois Press, 1949.

68. Shipley, W. C. An apparent transfer of conditioning. *Psychol. Bull.*, 1933, **30,** 541. (Abstract)

69. Skinner, B. F. *Verbal behavior.* William James Lectures, 1947. (To be published by The Harvard University Press.)

71. Stewart, G. R. *Man, an autobiography.* New York: Random House, 1946.

72. Strain, E. R. Establishment of an avoidance gradient under latent-learning conditions. *J. exp. Psychol.*, 1953, **46,** 391–399.

75. Thompson, G. G. *Child psychology, growth trends in psychological adjustment.* Boston: Houghton Mifflin, 1952.

77. Thorndike, E. L. *Educational psychology.* New York: Teachers Coll., Columbia Univer., 1925.

78. Tolman, E. C., & Gleitman, H. Studies in learning and motivation: I. Equal reinforcements in both end-boxes, followed by shock in one end-box. *J. exp. Psychol.*, 1949, **39,** 810–819.

79. Tomkins, S. S. Consciousness and the unconscious in a model of the human being. Unpublished manuscript.

81. Urban, W. M. *Language and reality—the philosophy of language and the principles of symbolism.* New York: Macmillan, 1939.

84. Werner, H. Change of meaning: a study of semantic processes through the experimental method. *J. gen. Psychol.*, 1954, **50,** 181–208.

86. Whorf, B. L. Science and linguistics. Notions about talking and thinking which compose a system of natural logic, go wrong in two ways; how words and customs affect reasoning. In *Collected papers on metalinguistics.* Washington, D.C.: Department of State, Foreign Service Institute, 1952. Pp. 3–7.

87. Wilson, K. In C. E. Osgood & T. A. Sebeok (Eds.), *Psycholinguistics—a survey of theory and research problems*. Bloomington: Univer. of Indiana Press, 1954. (Indiana University Publications in Anthropology and Linguistics, Memoir 10.)
88. Wyatt, Gertrude L. *Speech and interpersonal relations*. Glencoe, Ill.: Free Press, in press.
90. *Webster's new collegiate dictionary*. Springfield, Mass.: G. & C. Merriam Co., 1951.

19.

Operant Learning Principles and Communication*

Arthur W. Staats

Mowrer (1954) has suggested how one type of communication may be accounted for through the application of learning principles—in this case the principles of respondent conditioning and mediated generalization. This classic article makes an analysis of one function of language, a function which would seem to be widespread and important to much human learning. Nevertheless, the analysis does not tap the *various* principles of learning which appear to be important in the development of language and its function in verbal interactions popularly described as communication. The present article will analyze several aspects of operant conditioning within this area of communication.

For purposes of this discussion, verbal communication will be considered as the presentation of stimuli to a person resulting in the formation of new S-R mechanisms, or the elicitation of previously acquired S-R mechanisms. Since the discussion is limited to certain types of *verbal* communication, either the stimulus or response involved, or both, will be verbal.

Skinner (1957) has described the principle by which a stimulus may come to control a response through reinforcement procedures within the context of language (see selection 8 for a helpful summary). If a response is reinforced in the presence of a stimulus and not in its absence the stimulus will come to control the response in the sense that when the stimulus occurs the response will be more likely to occur. The stimulus will become what is called a discriminative stimulus, or S^D, for that response. There are several types of S^Ds that are important in language learning. Environmental stimuli become S^Ds for particular verbal responses. Skinner describes these verbal mechanisms as *tacts*. The words of others as auditory stimuli become S^Ds for imitative vocal responses, and these mechanisms are called *echoics* by Skinner. And visually presented verbal stimuli also become S^Ds for vocal responses in the acquisition of a reading repertoire. Skinner describes these verbal mechanisms as *texts*. These S-R mechanisms will be further described as they function in communication. For the moment, however, the principle of operant discrimination will be used to indicate another type of verbal mechanism of importance to communication.

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* From A. W. Staats, Operant learning principles and communication, *Technical Report No. 26,* Contract No. Nonr-2794(02) between the Office of Naval Research and Arizona State University, February 1964.

Verbal Stimulus, Motor Response Types of Communication

In addition to the above types of language learning, a child will also be trained to make certain non-verbal motor responses in the presence of appropriate verbal stimuli, either written or auditory. Let us say, as an example, that father says COME TO ME (an auditory stimulus to the child) and when the child responds by approaching the father, the father reinforces the child by a hug, a toss into the air, or the like. Under this type of training the verbal stimulus will become an S^D for the non-verbal approach behavior. Later in the child's life, as a consequence of many instances of this type of training, when someone says COME TO ME, the child will respond appropriately. This latter interaction would be called communication, both in a popular sense and in the definitional counterpart given herein.

It should be added, of course, that in any particular situation there will be multiple stimulus controls over the child's behavior. If the stimulus, COME TO ME, is emitted by an uncle who always pinches the child affectionately but painfully, or restrains the child too long, he will also become an S^D for "avoidance" responses. In this case, COME TO ME will not control an approach response. This qualification is described now, for this and the other cases to be discussed, to show that it is not a breakdown in communication, or a refutation of the principle of stimulus control. In the naturalistic setting there may be a multitude of stimuli which have controlling properties over the individual's behavior, and the action of a particular controlling stimulus may be obscured. To understand a behavior we must understand both the behavior principles as well as the particular history of experience of the organism.

To continue, however, the generality of this type of communication can be depicted with the help of two diagrams. Verbal stimuli as shown in Fig. 1 may as S^Ds come to control certain non-verbal motor behaviors. Ordinarily, the child will acquire a vast repertoire in which many diverse verbal stimuli will come to control many diverse motor responses. For the appropriately trained child, verbal stimuli (produced by oneself or another) will functionally control in this manner a great deal of adjustive behavior. Marked distortion, or absence, of this control will be viewed as a severe behavior problem.

In addition to the functional value of these controlling verbal mechanisms as

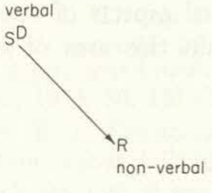


FIG. 1. A verbal stimulus can come to control a non-verbal motor response through operant discrimination learning.

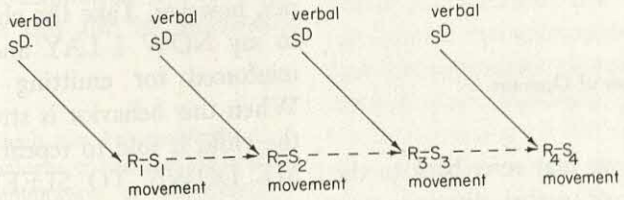
controlling mechanisms, on the basis of this type of repertoire it will be possible for the child to acquire further complex skills. That is, new sequences of nonverbal motor responses may be acquired simply on the basis of verbal instruction (i.e., the presentation of auditory verbal stimuli). For example, when the choreographer provides a series of verbal stimuli to the expert dancer, each of the stimuli will control a particular dance movement. In this case, the series of verbal stimuli by controlling a series of movements, will when repeated result in each movement coming to control the next to yield a new dance routine. A general example of this important type of human learning is depicted in Fig. 2 where each movement produces a stimulus which after practice will come to control the next response. Many complex motor skills are acquired by humans through this type of communication. Motor responses are controlled at first by verbal stimuli but later, after repetition and reinforcement, the motor skills come under the control of new stimuli—those produced by the preceding response.

Transfer of Operant Control from Sign to Sign

Mowrer discusses communication as the transfer of "meanings from sign to sign," that is, the higher-order respondent conditioning of a response elicited by one word to another word. According to this view, a new word could become meaningful through this process. Let us say that the word EVIL is unknown to the child and meaningless, although the child has been conditioned to respond to the word BAD. That is, in the past the child has been punished while being told he was BAD, thus making BAD a conditioned stimulus for various internal responses. Now when the child asks what EVIL means and is told EVIL MEANS BAD, this constitutes a conditioning trial. Each time he repeats the phrase he provides an additional conditioning trial. In this way EVIL will come to elicit the responses which BAD already elicits and thus EVIL will come in this sense to be meaningful.

It may also be suggested that an analogous process takes place upon the basis of operant conditioning. Let us say, for example, that the word CLOSE has become an S^D for the child such that it controls a "closing motor response." When

FIG. 2. When a series of verbal stimuli are presented, each of which controls a particular movement, and this process is repeated, the stimuli produced by each movement will come to control the next movement. In this way a new complex movement sequence can be established by language means.



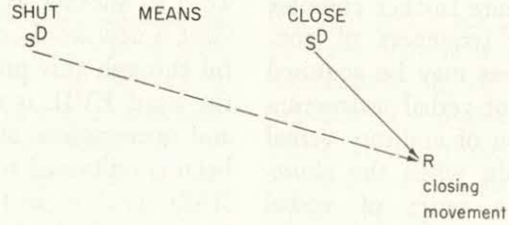


FIG. 3. When a word S^D which controls a motor response is paired in a sentence with a meaningless word, in this sense, the meaningless word becomes an S^D for that response. In the example, the new word SHUT becomes an S^D for the closing response through being paired with CLOSE in the sentence SHUT MEANS CLOSE.

presented with the verbal stimulus CLOSE THE DOOR the child makes the appropriate movement.

Let us also say that the word SHUT has never before been presented to the child and is, in essence, a nonsense syllable. It would be expected that if the child was told SHUT MEANS CLOSE that SHUT would come to control the response which CLOSE already controls. In the future if the child is told SHUT THE DOOR, he will respond appropriately. This is depicted in Figure 3.

One further general point may be made here. Word meaning has been discussed by a number of learning theorists as an implicit response which has been respondently conditioned to the word (Mowrer, 1954; Osgood, 1953; Staats, 1961). It can be added, however, on the basis of the above discussion, that a word may be meaningful also because it controls an operant motor response. Many verbs could be considered as meaningful, at least in part, in this sense.

Additional Cases of Operant Communication

At this point we may refer back to the other examples of verbal discriminative stimuli mentioned at the beginning of the present article. There are several additional cases of communication which involve these verbal mechanisms. First, it was said that some auditory verbal stimuli will come to control echoic (imitative) responses. After such a repertoire has been acquired it may enter into further communication acts. Thus, on the simplest level, when an individual instructs the child to say something and the child does so, this is a case of communication where an auditory verbal stimulus controls a vocal response.

More complex sequences of verbal responses may be developed in this manner, however. Take the child who is told to say NOW I LAY and who is then reinforced for emitting the sequence. When this behavior is strong, let us say, the child is told to repeat NOW I LAY ME DOWN TO SLEEP and then is reinforced—and so on. From this type of communication, long sequences of verbal

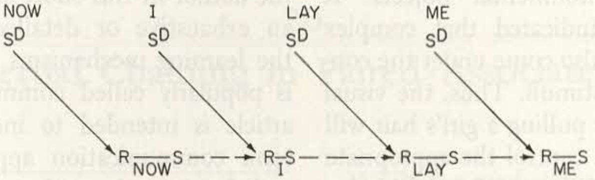


FIG. 4. When a series of verbal stimuli are presented each of which controls an echoic response (repetition) and the process is completed, that stimuli produced by each echoic response will come to control the next response. In this way new complex verbal response sequences can be established.

responses may be established. This is depicted in Fig. 4.[1]

The same type of communication can take place on the basis of reading (or *texting*) where the controlling verbal S^Ds are visually presented. This is also true of the other types of communication already discussed including the discussion by Mowrer (1954). The ability to produce various types of communication acts constitutes the most important functions of a reading repertoire. For example, when the individual has such a repertoire of reading responses to visually presented verbal stimuli, new complex verbal sequences can be established through the presentation of the verbal stimuli. Much learning in school is of this general type, for example, the acquisition of an extensive repertoire of verbal response sequences concerning history from responding to a book. In many cases these verbal response sequences have no other function, and learning is complete when they have been established and can be elicited under appropriate conditions.

New complex sequences of non-verbal motor responses can also be established from reading. For example, using a previous illustration, because the expert dancer's movements have come to be controlled by appropriate verbal stimuli (even when the verbal stimuli are a result of his own vocal or sub-vocal responses), the dancer can read about a new sequence of movements and the verbal response sequence he thus emits can then control a new sequence of movements. When repeated the dancer can acquire a new routine without personal instruction, or the opportunity of observing someone else. Because of these many possibilities, reading is one of the most powerful forms of human learning.

Finally, I would like to refer again to the other type of discriminative stimulus control described at the beginning of this article and indicate how this may enter into acts of communication. It was stated that environmental stimuli may come to control vocal responses. The child reinforced for saying COW while looking at the cow will tend to say COW the next time he sees such an animal. Through this type of training the child will come to give specific verbal responses to a wide number of environmental objects. It should also be indicated that complex verbal responses also come under the control of complex stimuli. Thus, the visual stimulus of a boy pulling a girl's hair will come as an S^D to control the appropriate verbal response sequence of an observing child, HE PULLED HER HAIR.

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[1] Research which may be considered an experimental analogue of this and the next type of communication is abundantly available in the extensive study of serial and paired associate verbal learning.

Based upon such a repertoire, it would then be quite possible to establish new sequences of verbal responses in a communication interaction by presenting a series of environmental objects to the individual. A silent film would be an example of a situation in which a sequence of non-verbal environmental stimuli each of which controlled verbal responses could result in a new complex verbal response sequence—which in this case would more or less accurately parallel the story of the movie. This may also be considered as communication.

The generality of this type of formation of new verbal response sequences can be seen by pointing out that the various environmental stimuli experienced by an individual in his life circumstances would be expected to produce characteristic verbal response sequences. These aspects of an individual's language are thus produced by non-verbal stimuli, and in this sense *the environment, both social and physical, "communicates" with the individual.* As the author has discussed more fully (Staats and Staats, 1963), when the environmental stimuli are novel, they may produce novel or original verbal responses —based upon the individual's *already* acquired language repertoire.

In conclusion, it is not the intention of the author in this short article to present an exhaustive or detailed discussion of the learning mechanisms whose function is popularly called communication. The article is intended to indicate that the term communication applies to various verbal interactions that involve diverse learning principles and verbal mechanisms. Perhaps, also, the discussion indicates how operantly learned language mechanisms can function both in controlling appropriate behavior and in producing new learning for the individual. These functions are important products of the individual's language repertoire. Perhaps, also, the discussion indicates, following Mowrer's presentation, that when the empirical principles of respondent and operant conditioning are integrated, even though the formulations derive from different theoretical orientations, they form a more powerful conception with which to consider human behavior—in this case certain aspects of language function.

REFERENCES

Mowrer, O. H. The psychologist looks at language. *Amer. Psychologist,* 1954, **9,** 660–694.

Osgood, C. E. *Method and theory in experimental psychology.* New York: Oxford University Press, 1953.

Skinner, B. F. *Verbal behavior.* New York: Appleton-Century-Crofts, 1957.

Staats, A. W. Verbal habit-families, concepts, and the operant conditioning of word classes. *Psych. Rev.,* 1961, **68,** 190–204.

20.

Implicit Verbal Chaining in Paired-Associate Learning*[1]

Wallace A. Russell and Lowell H. Storms

The role of covert symbolic processes in behavior determination has been emphasized by many psychological theorists, but the relative lack of supporting experimental evidence for this influence has been noted by several writers (2; 8, p. 110). Among the various factors deemed relevant to the operation of mediational or symbolic processes, the verbal habits of the individual have been prominently suggested. The work of Foley and Cofer (3) on verbally mediated generalization, and of Bousfield (1), Jenkins and Russell (6), and others working with recall, have established that the influence of such verbal associations can be studied effectively under experimental conditions.

While the mediational role of word associations has been demonstrated in several performance situations, there are surprisingly few studies which report positive findings with regard to the effects of mediated associations upon learning. Bugelski and Scharlock, using paired-associate learning and nonsense syllables, have provided what they term a "reasonably clear-cut demonstration of mediated association in the learning of verbal material" (2, p. 337). Their Ss showed facilitated learning of A-C associates when another term, B, presumably intervened between A and C as a consequence of previous learning of associations A-B and B-C. The term B, then, provided an implicit common term which was elicited by A and which in turn tended to elicit C. This mediation of the correct response C occurred even though Ss did not report deliberate use of the common term as a mnemonic device. The Bugelski and Scharlock data provide a much clearer instance of mediation than did the earlier experiments of Peters (12). Although the latter obtained some positive results, the majority of his test situations failed to demonstrate mediational effects.

Both Bugelski and Scharlock and Peters worked with associations learned within the context of the experiment and neither considered situations involving more than one intervening term. Nevertheless, applications of the mediation hypothesis have frequently referred to existing language habits and have almost always involved reference to a "chain" of several inter-

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* From W. A. Russell and L. H. Storms, Implicit verbal chaining in paired-associate learning, *J. exp. Psychol.*, **49**, 287–293 (1955). Reprinted by permission of the authors and the American Psychological Association.

[1] This study is part of a larger series of studies of verbal behavior being conducted at the University of Minnesota. The series is being sponsored by the Office of Naval Research (Contract No. N8 onr-66216) under its policy of encouraging basic research.

vening terms which are linked on an associative basis. Uni-process theorists who, according to Harlow (4, p. 452), maintain that "thinking is dependent only upon the formation and appropriate elicitation of a vast number of simple associations" have most commonly assumed that (*a*) mediational effects can occur across several intervening terms, and (*b*) these influences are at least as strong for associations between real words as between nonsense syllables. Hull's concept of pure stimulus acts (5), Miller's extension of the notion of verbally mediated generalization (10, p. 181), and Osgood's discussion of thinking (11, p. 638) are but a few examples in which one or the other of these assumptions has been made. However, neither Peters nor Bugelski and Scharlock provide a basis for these assumptions.

The purpose of this experiment was to test the adequacy of the above assumptions by observing the effects of mediating verbal processes on paired-associate learning when the mediating process is implemented in part by pre-existing language habits and extends over more than one implicit verbal term.

tion effects in the learning of A-C associations. In the study reported here, real words were used rather than nonsense syllables, and two implicit terms rather than one linked the pairs learned on the test trials. Here, the learning of List 1 established A-B associations. The B term was in each case a stimulus word from the Kent-Rosanoff association test (7). Recently obtained norms for responses on this test[2] then made it possible to infer certain B-C associations without establishing them experimentally. Similarly, other unpublished studies provided normative data concerning the most frequent associative responses (D) made to the C terms. Thus, once the A-B associations were learned, it was possible to infer an associative chain leading from A to B to C to D. The test for mediational effects was made by requiring *S*s to learn a list containing A-D pairings and appropriate control pairings (A-X) of nonchained terms. It was hypothesized that the A-D pairings would be learned more easily than the A-X pairings. The manner in which associative chains might facilitate the elicitation and learning of A-D pairs is schematically illustrated as follows:

	LIST 1	ASSOCIATIONS INFERRED FROM NORMS	LIST 2 (TEST LIST)
Chaining Paradigm	$A_1 \cdots > B_1$	$(B_1 \to C_1 \to D_1)$	$A_1 \cdots\cdots\cdots > D_1$ $\searrow (B_1 \to C_1) \nearrow$
Control Paradigm	$A_2 \cdots > B_2$	$(B_2 \to C_2 \to D_2)$	$A_2 \cdots\cdots\cdots\cdots > X_2$ $\searrow (B_2 \to C_2 \to D_2)$

Method

DESIGN

The design of this study was similar to that of Bugelski and Scharlock (2). Their *S*s learned three paired-associate lists: List 1 established A-B associations; List 2, B-C associations; and List 3 tested for media-

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[2] Revised norms for 100 words from the Kent-Rosanoff word-association test were obtained from 1008 students in beginning psychology classes at the University of Minnesota. This work was carried out as part of a larger project on verbal behavior. Information concerning these norms may be obtained from the authors.

Broken arrows indicate the association to be learned in each list. Solid arrows represent associations established before a list is learned. It can be seen that associations existing before the learning of the test list provide an indirect linkage of the A and D terms which must become associated in the chaining paradigm. In the control paradigm, a similar linkage exists between A and D, but no such connection can be inferred between the A-X pairs which are to be learned.

TABLE 1

Associative Frequencies of the Three Most Frequent Responses to Ten Kent-Rosanoff Stimulus Words (Based on R's from 1008 Ss)

STIMULUS	PRIMARY R	*f*	SECONDARY R	*f*	TERTIARY R	*f*
Stem	flower	402	plant	224	leaf	125
Memory	mind	119	remember	99	forget	80
Soldier	army	187	sailor	182	man	101
Trouble	bad	89	shooter	49	worry	45
Wish	want	124	dream	118	desire	112
Justice	peace	250	law	182	courts	163
Thief	steal	286	robber	138	crook	69
Ocean	water	314	sea	233	blue	111
Command	order	196	army	102	obey	78
Fruit	apple	378	vegetable	114	orange	94

From Russell and Storms: Implicit verbal chaining in paired-associate learning.

TABLE 2

Associative Frequencies of the Three Most Frequent Responses to Ten Primary Responses to Kent-Rosanoff Stimulus Words (Based on R's from 100 Ss)

WORD	PRIMARY R	*f*	SECONDARY R	*f*	TERTIARY R	*f*
Flower	smell	15	rose	12	pretty	12
Mind	brain	15	matter	14	think soul	12
Army	navy	39	service	7	soldier man	4
Bad	good	71	evil	4	mean	3
Want	need	27	desire	19	have	8
Peace	war	42	dove	10	quiet	8
Steal	take	14	thief	10	rob	8
Water	drink	19	thirsty	14	wet	11
Order	disorder	14	command	6	stop	5
Apple	tree	16	red	14	orange	13

From Russell and Storms: Implicit verbal chaining in paired-associate learning.

Construction of Paired-Associate Lists

Tables 1 and 2 contain the associative frequencies from the norms[3] for the three most frequent responses to the words relevant to this experiment. Table 1 provides this information for the ten Kent-Rosanoff stimulus words employed and Table 2 provides analogous data for the most frequent responses to those ten words.

Table 3 contains the nonsense syllables, the particular associative chains, and the control words used throughout the experiment. List 1 (A-B pairings) was made up of the nonsense syllables in Column A and the corresponding words in Column B. Columns B, C, and D list the verbal associative chains (B → C → D) derived from the normative tables. Two test lists were formed. One combined the first five nonsense syllables of Column A with the five corresponding words of Column D and the last five nonsense syllables with the corresponding words of Column X. The other combined the first five nonsense syllables in Column A with the five corresponding words of Column X and the last five nonsense syllables with the five corresponding words of Column D. Thus the two lists were counterbalanced and each contained five A-D and five A-X pairs. The response words of Form 1 of the test list are followed by a "1" in the table; the remaining words made up Form 2.

The ten nonsense syllables of Column A were selected from Melton (9), and all had Glaze association values of 0%. The ten verbal chains listed in Columns B, C, and D of the table were selected so that as far as the complete norms would indicate, no word in any chain appeared among the ten most frequent responses to any word in any other chain. In addition, no final word (D) in a chain appeared as a response to the first word (B) more than seven times in the 1008 responses to that word in the norms. It may be noted that while Column C is essential to the construction of the ten associative chains, no words in that column appeared in any of the experimental lists. The control words in Column X were chosen from the Kent-Rosanoff list such that none appeared among the ten most frequent responses to any of the chained words and no chained word appeared among the ten most frequent responses to a control word. Finally, the control words were matched with the final words of each chain on the basis of Thorndike-Lorge (13) frequency as a partial equalization of difficulty between control and experimental words.

Procedure

Twenty-seven sophomore women from a beginning psychology class served as Ss.

Following general instructions on paired-associate learning, each *S* learned List 1 on a standard Hull-type memory drum. Each stimulus word was exposed for 2 sec. before the response word appeared beside it for another 2-sec. period. The next stimulus word followed immediately, except that 4 sec. elapsed after each complete trial through the list. The *S* was required to learn the ten pairs in List 1 to a criterion of three consecutive trials in which all response words were correctly anticipated. To control for serial position effects, the list was presented in three successive random orders of pairs before the first order was repeated. Three Ss failed to reach the criterion on List 1

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[3] See footnote 2.

TABLE 3

Nonsense Syllables, Associative Chains, and Control Words Used in Forming the Paired-Associate Lists

A	B	C	D	X
NONSENSE SYLLABLE	FIRST CHAINED WORD	SECOND CHAINED WORD	FINAL CHAINED WORD	CONTROL WORD
Cef	stem	flower	smell (1)	joy
Dax	memory	mind	matter (1)	afraid
Yov	soldier	army	navy (1)	cheese
Vux	trouble	bad	good (1)	music
Wub	wish	want	need (1)	table
Gex	justice	peace	war	house (1)
Jid	thief	steal	take	sleep (1)
Zil	ocean	water	drink	doctor (1)
Laj	command	order	disorder	cabbage (1)
Myv	fruit	apple	red	hand (1)

Note. The words and syllables were presented in capital letters exactly as above. The response words of Form 1 of the test list are followed by a "1."

From Russell and Storms: Implicit verbal chaining in paired-associate learning.

within 40 min. and were not used further in the experiment.

After a pause of 4 min., each remaining S was presented with either Form 1 or Form 2 of the test list. The Ss were instructed that the procedure was exactly the same as for List 1 and were urged to do their best on the test list. Since one S failed to reach the criterion of one trial in which all the response words were correctly anticipated, there remained 23 Ss for the final analysis of results. Twelve of these learned Form 1 of the test list and 11 learned Form 2.

For each S, all correct anticipations and errors were tabulated for both List 1 and the test list. Measures used in the final analysis were: (*a*) the number of trials required to reach the criterion on List 1; (*b*) the number of mediated (D) and unmediated (X) responses occurring in the first five different correct anticipations by each S; (*c*) the total number of correct responses made for the mediated (D) and unmediated (X) words during the test trials.

Control Experiment

Twelve additional female Ss from the same population were used in a subsequently performed control experiment designed to allow a comparison of the learning of A-D and A-X pairs in a situation where associative chaining could not differentially contribute to the learning of the pairs. Instead of learning List 1, these Ss first learned either Form 1 or Form 2 of the test list. The second list was the other form of the test list. Thus, in the control experiment, associative facilitation due to A → B → C → D linkages was not possible because the A-B associations of List 1 were not learned by any S. The analysis of results for the control *Ss* was based on measures similar to those of the main experiment.

Results

Since two forms of the test list and two groups of *Ss* were involved in the design, the equivalence of the two lists and the two groups must be established before the combined results can be dealt with. An analysis of the mean number of trials required to reach the criterion of learning on List 1, which all *Ss* learned, indicated that the 12 *Ss* who subsequently learned Form 1 of the test list did not differ significantly ($t = .52$) from the 11 *Ss* who subsequently learned Form 2 of the test list. The mean for the former group was 25.00 ($SD = 9.17$); for the latter it was 22.91 ($SD = 9.30$). With respect to performance on the two forms of the test list, the mean number of correct anticipations per *S* during learning did not differ significantly between Forms 1 and 2. The means for Forms 1 and 2 were, respectively, 67.08 ($SD = 30.75$) and 58.09 ($SD = 17.04$). The Behrens-Fisher *d* of .87 did not allow rejection of the null hypothesis concerning form differences.

As a consequence of these comparisons, the results from Forms 1 and 2 of the test list were combined. In order to determine whether the response terms for A-D pairs, for which associative chaining was possible, were more easily elicited during the early trials, an analysis was made of the first five different correct responses made by each *S*. Of the 115 responses in this analysis, 67 were members of "chained" A-D pairs and 48 were from "unchained" A-X pairs. The normal curve approximation to the binomial indicates that a result this large and in this direction would occur by chance less than 4 times in 100 if the probabilities of successes for A-D and A-X pairs were equal. Of the 23 *Ss* in this part of the experiment, 19 showed more chained than unchained responses in their first five different correct responses. The same one-tailed binomial test indicated that this result would occur by chance only 1 time in 1000 if the probabilities of successes for all pairs were equal. The conclusion that chained words were more easily elicited during the early trials of learning seemed warranted.

The major purpose of the experiment, however, was to compare the ease with which chained and unchained pairs were learned. The design allowed this comparison to be made with each *S* acting as her own control. Since each *S* learned an equal number of chained (A-D) and unchained (A-X) pairs, the total number of correct anticipations by each *S* for the unchained pairs was subtracted from the corresponding total for chained pairs. If there is facilitation of the learning of chained pairs (i.e., *S* has a larger number of correct anticipations on the A-D than on the A-X pairs) this difference will be positive. Over all *Ss* the mean difference between chained and unchained pairs was 3.74 ($SD = 5.32$). A t of 3.30 ($.01 > p > .001$) leads to rejection of the null hypothesis, and the conclusion that there was facilitation of learning of A-D pairs as contrasted with the learning of A-X pairs.

A secondary analysis of performance on Form 1 and Form 2 separately revealed that the direction of the difference between chained and unchained pairs was positive for both forms (Form 1, $M = +4.92$, $SD = 5.85$; Form 2, $M = +2.45$, $SD = 4.31$). For Form 1, the t of 2.79 was significant at the .02 level of confidence. For Form 2, the *t* of 1.80 was between the .15 and .10 levels.

It was recognized that, if for reasons other than associative chaining, the A-D pairs were as a group intrinsically easier to learn than the A-X pairs, the results obtained here could be accounted for on the basis of that factor alone. The control study was run to provide information about the relative difficulty of A-D and A-X pairs in a situation where chaining of A-D pairs was not possible. The 12 Ss in the control experiment learned both Forms 1 and 2 of the test list. The performance of these Ss on whichever form was learned last provided the basis for the analysis of the control experiment. First, the mean number of correct anticipations of the response word was determined for the ten A-D and the ten A-X pairs. The means were 7.06 and 7.35 respectively, with *SD*'s of 1.29 and 1.39. This difference did not approach significance and the direction of difference is unfavorable to the hypothesis that the A-D pairs were easier to learn than the A-X pairs. Finally, the two major analyses of the main experiment were repeated here. As Table 4 indicates, neither of the differences tested was significant, and in each case the direction of difference did not favor the A-D pairs. In the absence of the possibility of associative chaining, then, there was no evidence of easier learning of the A-D pairs used in this experiment.

DISCUSSION

Statistically, these results provide stronger evidence for mediational effects in learning than do the results of Bugelski and Scharlock (2). This is true in spite of the fact that the present experiment involves one more step in the chain of associations mediating the facilitated learning. Instead of an A-B-C sequence contributing to the learning of A-C, an A-B-C-D chain contributed to the learning of A-D. This demonstration of mediational influences extending over more than one intervening term, and involving language habits established prior to the experiment, offers some confirmation for theoretical explanations of thinking, problem solving, etc., which have postulated

TABLE 4

Summary of Major Results

	INITIAL SUCCESSFUL ANTICIPATIONS (FIRST 5 DIFFERENT CORRECT R'S FOR EACH S)			TOTAL CORRECT RESPONSES: MEAN OF CHAINED MINUS UNCHAINED	
EXPERIMENT	CHAINED	UNCHAINED	SIGNIFICANCE OF DIFFERENCE	(3)	SIGNIFICANCE
Main	67	48	.04	+3.74	.01
Control	30	30		−0.50	

From Russell and Storms: Implicit verbal chaining in paired-associate learning.

the operation of such complex implicit associative sequences. . . .

The fact that questions following the experiment yielded no evidence that *S*s could verbalize the mediating terms only emphasizes the Bugelski-Scharlock conclusion that mediated association may be "unconscious."

SUMMARY

This experiment was designed to study the effects of mediating verbal processes on paired-associate learning when the mediating process is implemented in part by pre-existing language habits and extends over more than one implicit verbal term.

First, ten chains of word associations, B-C-D, were constructed from normative data on association frequencies. Twenty-three female college *S*s then learned a list of A-B pairs where the A terms were nonsense syllables and the B terms were the initial members of the chains described above. The test situation required that *S*s learn another list consisting of A-D and A-X pairs. The D terms were the final members of the associative word chains, and the X terms were not associated with any of the chains. A control experiment revealed that the A-D and A-X pairs did not differ in difficulty in the absence of chaining possibilities.

It was found that the A-D pairs were learned significantly faster, and elicited earlier in learning, than the A-X pairs. It was concluded that implicit verbal chains of more than one link mediated these effects. Reasons for these results being even more clear-cut than those of schematically simpler previous experiments were discussed.

REFERENCES

1. Bousfield, W. A. The occurrence of clustering in the recall of randomly arranged associates. *J. gen. Psychol.*, 1953, **49,** 229–240.
2. Bugelski, B. R., & Scharlock, D. P. An experimental demonstration of unconscious mediated association. *J. exp. Psychol.*, 1952, **44,** 334–338.
3. Foley, J. P., Jr., & Cofer, C. N. Mediated generalization and the interpretation of verbal behavior: II. Experimental study of certain homophone and synonym gradients. *J. exp. Psychol.*, 1943, **32,** 168–175.
4. Harlow, H. F. Thinking. In H. Helson (Ed.), *Theoretical foundations of psychology*. New York: D. Van Nostrand, 1951. Pp. 452–500.
5. Hull, C. L. Goal attraction and directing ideas conceived as habit phenomena. *Psychol. Rev.*, 1931, **38,** 487–506.
6. Jenkins, J. J., & Russell, W. A. Associative clustering during recall. *J. abnorm. soc. Psychol.*, 1952, **47,** 818–821.
7. Kent, G. H., & Rosanoff, A. J. A study of association in insanity. *Amer. J. Insanity*, 1910, **67,** 37–96, 317–390.
8. McGeoch, J. A., & Irion, A. L. *The psychology of human learning*. New York: Longmans, Green, 1952.
9. Melton, A. W. Materials for use in experimental studies of the learning and retention of verbal habits. Unpublished manuscript, Univ. of Missouri, 1940.
10. Miller, G. A. *Language and communication*. New York: McGraw-Hill, 1951.
11. Osgood, C. E. *Method and theory in experimental psychology*. New York: Oxford Univ. Press, 1953.
12. Peters, H. N. Mediate association. *J. exp. Psychol.*, 1935, **18,** 20–48.
13. Thorndike, E. L., & Lorge, I. *The teacher's word book of 30,000 words*. New York: Teachers Coll., Columbia Univ., 1944.

21.

Conditioned Stimuli, Conditioned Reinforcers, and Word Meaning*[1]

Arthur W. Staats

In psychology, in various areas, there has been a tendency towards separatism—not only between major schools of thought, but also within these divisions. As a consequence there is a correlated tendency for an investigator influenced by one approach to generally eschew the other, and each continues his activities largely in ignorance of the other. Separate terminologies have occurred which tend to prevent the integration of findings made in the separated fields. Thus, for example, in the field of a learning approach to language, there are several largely isolated endeavors. There are those interested in verbal learning which primarily involves the principles and procedures of serial and paired associate learning. Then there are those who are interested in the semantic properties of words in terms of respondent conditioning principles. And there are those whose interest is in the operant conditioning of verbal behavior.

For the most part, these works have remained largely uncontaminated by one another, although in each case the investigations spring from learning principles. It may be suggested, however, that one of the tasks of a learning approach to psychology is to integrate its principles into a coherent framework with which to incorporate the diverse empirical findings within the field as well as findings outside of the field of learning. The present author has attempted an integration in various areas of language learning (Staats, 1961, 1963, 1964a; Staats and Staats, 1963), and the present paper will discuss additional possibilities of this type.

More specifically, consideration of the operations involved suggests that conditioned stimuli and conditioned reinforcers develop according to the same principles. And this has implications for understanding certain aspects of language development and function.

Conditioned Stimuli and Conditioned Reinforcers

Originally, within the operant conditioning approach, conditioned reinforcers were considered to be formed in a procedure of operant discrimination. The process was not considered in terms of respondent conditioning principles. For example, Keller and Schoenfeld (1950) stated the following. "From the viewpoint of procedure, the training conditions for obtaining an S^r are the same as those for obtaining an S^D. We must first make an S^D of the stimulus we wish to use later as an S^r" (1950, p. 236).

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* From A. W. Staats, Conditioned stimuli, conditioned reinforcers, and word meaning, *Technical Report No.* 27, Contract No. Nonr-2794(02) between the Office of Naval Research and Arizona State University, February 1964.

More recently, investigators of an operant orientation have begun to recognize that S^rs are formed in respondent conditioning procedures. For example, Kelleher and Gollub in a review of the literature on positive conditioned reinforcement state the following. "A stimulus repeatedly presented just before a primary reinforcer can acquire reinforcing properties. Operationally, this procedure resembles the respondent conditioning procedure; that is, the presentation of the primary reinforcing stimulus is contingent upon the presentation of the conditioned reinforcer rather than upon a response" (1962, p. 545). (Nothing is said, however, of the possibility that the stimulus owes its acquired reinforcing function to the fact that as a *CS* it has come to elicit a conditioned response.)

This change in interpretation of the procedures involved in establishing a stimulus as a conditioned reinforcer constitutes a swing back towards the view of Clark Hull as set forth in *Principles of Behavior* (1943). Although Hull did not distinguish between operant and respondent conditioning, he suggested that the procedure of classical (respondent) conditioning, in which a neutral stimulus is paired with a stimulus which elicits a response, produced two results. First, the neutral stimulus would come to elicit the response (or part of it), that is, become a conditioned stimulus (*CS*). In addition, Hull stated that such a conditioned stimulus would then be able to reinforce a response in an operant sense. That is, according to present day conceptions, a stimulus which had become a *CS* and would elicit some conditioned response, would by virtue of this process also have acquired an operant reinforcing function. This could be shown by presenting the stimulus following a response in which case the frequency of occurrence of the response would increase. A stimulus which has acquired such reinforcing value was called a secondary reinforcer, or conditioned reinforcer (S^r).

Hull was very clear in suggesting that the ability of the stimulus to serve as a conditioned reinforcer depended upon the stimulus being a *CS* for the conditioned response. "Stimuli which acquire secondary reinforcing power seem always to acquire at the same time a conditioned tendency to evoke an associated reaction. The available evidence indicates that as such stimuli lose through extinction the power of evoking this reaction, they lose in about the same proportion their power of secondary reinforcement. It is probable also that the reverse is true; that a stimulus gradually acquires its powers of secondary reinforcement as it acquires the power of evoking the reaction conditioned to it" (p. 98). Mowrer (1960) has also made an essentially similar analysis.

This view is supported by the fact that intermittent conditioning procedures produce *CS* which are more resistant to extinction (e.g., Grant, D. A. and Schipper, L. M., 1952), as well as S^rs that are more resistant to extinction (Zimmerman, 1957). That is, an acquisition variable effects in the same manner this measure of the strength for both. It might also be expected that number of conditioning trials, time between *CS* and *UCS*, and so on, which effect the strength of a *CS*, would also effect in a like manner the strength of an S^r.

Hull also pointed out that higher-order conditioning of reinforcers should also be capable of occurring. This is a derivation from the principles of respondent conditioning. That is, using the present terminology, after a stimulus becomes a *CS* for a response, the *CS* can be paired with a new stimulus and the new stimulus will also become a *CS* for the response. By the same process, a new stimulus which is paired with a *CS* which is also a conditioned reinforcer (S^r) should also become a conditioned reinforcer as it becomes a *CS*. As will later be described, the extension of the principle of higher-order conditioning to the formation of conditioned reinforcers is one of the important aspects of an analysis which treats conditioned reinforcement in terms of respondent conditioning principles.

It might be suggested here that it would have an integrating effect, as well as a heuristic effect, for a convention to be established which would more effectively indicate the relationship of the *CS* and S^r properties of a stimulus. As a function of pairing a stimulus with a *UCS*, the stimulus comes to elicit a conditioned response, and for this reason is called a conditioned stimulus, or *CS*. If, as a function of becoming a conditioned stimulus, the stimulus also acquires reinforcing value, a designation for this added property should be affixed to abbreviate the term conditioned reinforcing stimulus as CS^r.

It should also be pointed out, that not all *UCS* may be considered to be reinforcers, although they serve to elicit some response on an unlearned basis. Thus, a flash of light elicits a pupil contraction which can be conditioned, but the flash of light may be quite neutral, or almost so, in terms of reinforcing value. A tap to the knee may elicit a knee jerk while having little reinforcement value. Thus, *UCS* could be expected to vary in reinforcement value—some being either positive or negative in differing degrees, and some being neutral. To follow the convention already suggested for conditioned stimuli, it would seem appropriate to designate *UCS* which have reinforcing value as UCS^R, and those which do not simply as *UCS*. A neutral stimulus paired with a *UCS* would be expected to become a *CS* but not a CS^r.

This analysis may be considered the basic theory. The rest of the paper will be concerned with matters within the area of language development and function which derive from the analysis and which bear upon it.

Word Meaning and Conditioned Reinforcement Value

The contemporary behavioral conception of word meaning has its roots in Hullian formulations (Hull, 1930) as they were extended to the area of language by Osgood (1953). Although Osgood, following Hull, labels his analysis as a reinforcement approach, the model applied to the development of word meaning, when considered in terms of procedures, actually involves respondent conditioning. And it has been treated in this manner by later theorists (Mowrer, 1954; Staats, 1961).

According to this view, in the development of word meaning, a word is a conditioned stimulus and the meaning is a conditioned response. The word (*CS*) comes to elicit this conditioned response by being paired with a stimulus object (*UCS*) which already elicits the response. Naturalistic observation indicates there is ample opportunity for such conditioning to occur—many words are systematically paired with certain other stimulus events and should come to elicit parts of the responses elicited by these stimuli.

Furthermore, there are experimental results which support the relevance of the application of respondent conditioning principles to the study of the development of word meaning (Staats, Staats, and Crawford, 1962). In this study, a word (LARGE) was paired as a *CS* with aversive stimuli (either electric shock or a loud noise) 9 out of the 14 times the word was presented in a list of words the subjects were ostensibly to learn. After this treatment it was found that the *CS*-word had acquired a negative meaning. That is, the subjects, in comparison to a control group of subjects, rated the meaning of the word toward the unpleasant pole of a 7-point pleasant-unpleasant scale. The meaning had been conditioned to a word by means of respondent conditioning procedures.

In addition, during the experiment the subjects' *galvanic skin response* (*GSR*) to the *CS*-word was also recorded. It was found that in the conditioning procedure that the *CS*-word had come to elicit the *GSR* as a result of having been paired with the *UCS* (shock and noise) for this response. Moreover, the extent of the conditioning of the *GSR* was found to be positively correlated with the extent of the conditioning of the meaning of the *CS*-word. This finding also supports the treatment of meaning as a respondently conditioned response, and suggests that the *GSR* and meaning conditioning were parallel processes—if not the same process.

If word meaning is respondently conditioned, however, it would also be expected that higher-order conditioning of meaning would occur. In higher-order conditioning a stimulus which was formerly a *CS* is used as the *UCS* in conditioning a response to yet a new stimulus. Thus, in the example above, the word LARGE after having come to elicit the negative meaning response could be paired with another neutral word. It would be expected this would make the new word also elicit a negative meaning.

Based upon this rationale, the present author developed an experimental method with which to further study word meaning. In the method, a meaningless verbal stimulus (*CS*) was paired one time each with a set of words (*UCS*) each of which already elicited a type of meaning. The *CS*-verbal stimulus as a consequence of this procedure should acquire the meaning of the *UCS*-words, which is what occurred. The use of this method in a series of studies has indicated that word meaning appears to be capable of higher-order conditioning (e.g., Staats and Staats, 1957; Staats, Staats, and Heard, 1961).

As the principle of higher-order conditioning would suggest, it should also be possible for words that elicit evaluative meaning to be paired with stimulus *objects*, thus conditioning the evaluative meaning to the objects. This process has been shown in a study by Di Vesta and Stover (1963). First, nonsense syllables were made *CS* for evaluative meaning using the higher-order conditioning procedure described above. Then stimulus objects were labeled by the nonsense syllables. It was found that the objects had acquired the evaluative meaning of their labels.

If word meaning of this type is a conditioned response, then additional principles should also hold. For example, a greater number of conditioning trials should produce greater conditioning. This has been shown (Staats, and Staats, 1959) in a study in which the *CS*-word was paired a different number of times with words having a particular meaning in the procedure described above. The greater the number of conditioning trials, the more strongly was the meaning conditioned. It has also been shown (Staats and Staats, 1960) that intermittent pairing of a *CS* verbal stimulus with *UCS* words produces less intense conditioning than does continuous pairing, as would be expected from basic studies of respondent conditioning (see Ross, 1959).

Thus, it appears appropriate to consider the development and transfer of word meaning in terms of respondent conditioning principles. This account, however, does not indicate the *import* of the development of word meaning. What, one may ask, is the function of words that have acquired meaning? The following discussion will be concerned with one aspect of the function of meaningful words, in particular, with words that have evaluative meaning as defined by Osgood (Osgood, Tannenbaum, and Suci, 1957).

In the previous section of this paper it was suggested that a stimulus as it becomes a *CS* for a response will in some cases also become a conditioned reinforcer, CS^r. This second function will be acquired when the unconditioned stimulus is a type which would be termed a primary reinforcer or UCS^R. Having discussed word meaning in terms of respondent conditioning, it would be expected from the preceding analysis that a CS-word that had come to elicit a certain type of meaning response would also by the same process have become a conditioned reinforcer.

For example, in the study previously mentioned in which the word LARGE was paired with electric shock and noise as the *UCS*, LARGE became a *CS* for an "unpleasant" meaning response and a galvanic skin response. Since the unconditioned stimuli used were primary negative reinforcers, however, it would also be expected that LARGE would have become a conditioned negative reinforcer and, to the extent of this effect should *function* as such. That is, if the word was presented contingent upon a response it should decrease the strength of that response. Or if the word was withdrawn following a response, this should increase the strength of the response.

The above suggests that a stimulus word which has negative evaluative meaning will function as a negative reinforcer. The same suggestion is given for the relationship between positive evaluative meaning and positive reinforcement value by a study of Schutz and Naumoff (1963). These investigators have shown that a meaningless verbal stimulus (nonsense syllable) when used as a CS and paired with a *UCS* that is a positive reinforcer (money) will acquire positive evaluative meaning as measured by semantic differential rating scales. Extension of the principle by which conditioned reinforcers are established would also lead to the expectation in this study that the verbal stimulus would at the same time have acquired positive reinforcement value.

Thus, in general, it would be expected that words which are rated on the type of seven-point scale used in these studies, either at the positive (pleasant) pole or at the negative (unpleasant) end, should function as positive or negative reinforcers. And, there are many words which fall into one of these two categories. In studies which use these 7-point rating scales, called semantic differentials, Osgood and associates (Osgood, Suci, and Tannenbaum, 1957; Triandis and Osgood, 1958) have shown that one of the important and universal ways that word meaning can vary is in its evaluative dimension.

Naturalistic evidence also supports the contention that words which have evaluative meaning actually function as reinforcing stimuli, both as positive and negative reinforcers. That is, people seem to do many things to "escape" negative meaning words, while positive meaning words appear to strengthen and maintain behavior which they follow.

Moreover, there are several types of experimental evidence which support the preceding analysis of the relationship of evaluative word meaning and reinforcement value, as well as the more basic analysis of the relationship of conditioned stimuli and conditioned reinforcers. First, a number of studies (see Krasner, 1958) have shown that words which have positive evaluative meaning, for example the words GOOD and FINE, when applied contingent upon a class of verbal responses will increase the frequency of emission of those responses. Thus, these words of positive evaluative meaning have been shown to function as reinforcers.

Portnoy and Salzinger (in press) had verbs rated on semantic differential scales, obtaining classes of words with positive, negative, and neutral evaluative meaning. These words were found to be in a response class susceptible to operant conditioning in a procedure in which one word of each class was presented to the subject on a card along with 3 personal pronouns. The subject had to choose one of the verbs and a pronoun and construct a sentence. All of the positive, negative, and neutral verbs were presented this way and the class of verbs selected was later manipulated by the experimenter depending upon which class was reinforced. Of interest to the present discussion, however, is the fact that *prior* to the institution of reinforcement for choosing one of the verb classes (the pre-conditioning period), subjects selected positive meaning verbs more frequently than the neutral or negative ones. Portnoy and Salzinger suggest that this indicates that " 'good' verbal responses have in the history of these *S*s been associated with positive reinforcement and therefore have acquired positively reinforcing properties themselves" (p. 6).

Furthermore, based upon the previously presented rationale that positive and negative evaluative meaning words should function as reinforcers, a study (Finley and Staats, 1964) has been conducted in which words with evaluative meaning were presented contingent upon a response and the effect upon the frequency of emission of the response was assessed. The study was conducted as follows. A group of positive evaluative meaning words, a group of negative evaluative meaning words, and a group of words without evaluative meaning were selected on the basis of semantic differential ratings of 6th grade children. Then other 6th grade children were used as subjects in a situation where the task was to press either a right-hand button or a left-hand button when a light in front of the subject was illuminated. After a pre-conditioning period to tabulate the frequency of the two responses, the positive, negative, or non-evaluative meaning words were presented contingent upon each left-hand response. For one group of subjects each left-hand response occasioned the auditory presentation of a positive meaning word, for another group a negative meaning word, and for a third group a non-evaluative meaning word. Over 6 blocks of 10 trials (the first block was pre-conditioning) of making one or the other response, the subjects increased in their rate of emission of the left-hand response when the response was followed by positive evaluative meaning words. When the negative evaluative meaning words were presented contingent upon the response, the response decreased in frequency. The words without evaluative meaning, although they were meaningful in other ways, did not systematically increase or decrease the strength of the response.

The results showed that words with positive evaluative meaning function as positive reinforcers, words with negative evaluative meaning function as negative reinforcers, and words without evaluative meaning, although otherwise meaningful, do not function as reinforcers. In the light of the previous treatment of word meaning as respondently conditioned, these results support Hull's contention that conditioned reinforcement value is respondently conditioned and that it depends upon the conditioned response. Furthermore, the experiment helps integrate the study of word meaning and the semantic rating of words with the principles and findings of operant conditioning. It also suggests that semantic differential rating scales can be used to measure the reinforcement value of stimuli, that is, the extent to which stimuli will shape and maintain human behavior. This suggestion has a good deal of significance since the study of psychological measurement, as one example, concerns to a large extent the assessment of the reinforcing value of stimuli, as in tests of interests, values, attitudes, and personality.

SUMMARY AND CONCLUSIONS

It has been suggested herein, that some *UCS* are also primary reinforcers, or UCS^R. When this is the case, following Hull's original analysis, the response elicited by the UCS^R will be conditioned to any neutral stimulus with which the UCS^R is paired. In that case the neutral stimulus will become a *CS* in the sense that it will now elicit the response. In addition, as a consequence of this conditioning, the neutral stimulus will acquire the reinforcement value of the UCS^R, thus becoming a CS^r. Higher-order conditioning of these eliciting and reinforcing properties can also occur from a CS^r to a new neutral stimulus.

In the area of language, extension of these principles suggests that words may become conditioned eliciting stimuli (*CS*), and as a consequence will also be conditioned reinforcing stimuli (CS^r). It has also been suggested that measures of evaluative word meaning, which have been referred to the eliciting property of words, also give indications of reinforcing value. Several sources of empirical support for these expectations were described.

There are implications of this analysis which indicate that it has import besides the establishment of economical terminological conventions within the language of a science. On its most general level, a vital aspect of human behavior involves the stimuli which are reinforcing for the individual. This is a primary concern of the field of human motivation. And, the manner in which humans vary in this respect, and these variations are large, depends upon differences in conditioned reinforcers. Many of the stimuli which shape and maintain human behavior through their reinforcing function are not primary reinforcers such as food, water, tactual stimuli (as in sexual contact), warmth, and so on. Human motivational stimuli are largely learned. For this reason, understanding the principles of the formation and function of conditioned reinforcers is important. Furthermore, since many of these conditioned reinforcers are verbal, and the procedures for creating new conditioned reinforcers are often based upon other word reinforcers, it is necessary to understand the way in which the basic principles apply to language.

A few cursory examples may serve to illustrate some of the areas of application of these statements. In the area of clinical psychology, respondent conditioning techniques (see Eysenck, 1960) have been used for some time in aversion therapy. Thus, alcohol as a *CS* may be paired with electric shock. Although the procedure is respondent conditioning, it is the change in reinforcing value of the stimulus that is important, that turns the patient's "approach" response to one of "escape." Explicit realization of the two principles involved might be expected to yield more precise knowledge of the procedures and their effects.

In addition, verbal psychotherapy can be seen, in the light of the preceding discussion, to involve respondent conditioning procedures in which words as *CS* are used to change the reinforcing value of other words and objects important in the patient's life. The change in reinforcing value then effects the patient's behavior. Abnormal behavior has been considered by the present author (Staats and Staats, 1963) in terms of the unusual development of such conditioned reinforcers.

In social psychology, attitude formation can be considered to involve the development and function of conditioned reinforcers. And the study of group cohesiveness is the study of the (respondent) principles by which people in a group as stimuli for each other acquire reinforcement value by verbal and nonverbal conditioning (see Lott and Lott, 1960), as well as the study of the (operant) principles by which group member behavior is affected.

In educational psychology, a primary concern of educators with the motivation of children may be considered within the principles that have been presented. For example, the stimuli produced by learning itself must become a reinforcer if the pupil's attention and studying behavior is to be maintained in the classroom situation. Other important sources of conditioned reinforcers are the approval of the teacher, parents, siblings, and schoolmates (see Staats and Staats, 1963). Understanding the principles by which reinforcers are formed and by which they effect pupil's behavior is central to the treatment of many educational problems. (In this and the other examples, other articles in the present book will make further elaborations of these suggestions.)

REFERENCES

Di Vesta, F. J., and Stover, D. O. The semantic mediation of evaluative meaning. *J. exp. Psychol.*, 1962, **64,** 467–475.

Eysenck, H. J. (ed.) *Behavior therapy and the neuroses.* London: Pergamon Press, 1960.

Finley, J. R., and Staats, A. W. Evaluative meaning words as reinforcing stimuli. *Technical Report No.* 28, Contract No. Nonr-2794(02), between the Office of Naval Research and Arizona State University, in preparation.

Grant, D. A., and Schipper, L. M. The acquisition and extinction of conditioned eyelid responses as a function of the percentage of fixed-ratio random reinforcement. *J. exp. Psychol.*, 1952, **43,** 313–320.

Hull, C. L. Knowledge and purpose as habit mechanisms. *Psychol. Rev.*, 1930, **37,** 511–525.

Hull, C. L. *Principles of behavior.* New York: Appleton-Century, 1943.

Kelleher, R. T., and Gollub, L. R. A review of positive conditioned reinforcement. *J. exp. anal. Behav.*, **1962,** 543–597.

Keller, F. S., and Schoenfeld, W. N. *Principles of psychology.* New York: Appleton, 1950.

Krasner, L. Studies of the conditioning of verbal behavior. *Psychol. Bull.* 1958, **55,** 148–170.

Lott, B. E., and Lott, A. J. The formation of positive attitudes toward group members. *J. Abnorm. Soc. Psychol.*, 1960, **61,** 297–300.

Mowrer, O. H. The psychologist looks at language. *Amer. Psychol.*, 1954, **9,** 660–694.

Mowrer, O. H. *Learning theory and behavior.* New York: Wiley, 1960.

Osgood, C. E. *Method and theory in experimental psychology.* New York: Oxford Univer. Press, 1953.

Osgood, C. E., Suci, G. J., and Tannenbaum, P. H. *The measurement of meaning.* Urbana: University of Illinois Press, 1957.

Portnoy, S., and Salzinger, K. The conditionability of different verbal response classes: positive, negative, and non-affect statements. *J. gen. Psychol.*, in press.

Ross, L. E. The decremental effects of partial reinforcement during acquisition of the conditioned eyelid response. *J. exp. Psychol.*, 1959, **57,** 74–82.

Schutz, R. E., and Naumoff, H. An application of Mowrer's sentence conditioning paradigms in developing evaluative meaning. *J. verb. Learning. verb. Behav.*, 1963, **1,** 459–462.

Staats, A. W. Verbal habit-families, concepts, and the operant conditioning of word classes. *Psychol. Rev.*, 1961, **68,** 190–204.

Staats, A. W. Comments on Professor Russell's paper. In *Verbal behavior and learning* (ed. by C. N. Cofer and B. S. Musgrave). New York: McGraw-Hill, 1963.

Staats, A. W. Operant learning principles and communication. *Technical Report No.* 27, Contract N. Nonr-2794(02), between the Office of Naval Research and Arizona State University, 1964a.

Staats, A. W., and Staats, C. K. Effect of number of trials on the language conditioning of meaning. *J. gen. Psychol.*, 1959, **61,** 211–223.

Staats, A. W., and Staats, C. K. *Complex human behavior.* New York: Holt, Rinehart and Winston, 1963.

Staats, A. W., Staats, C. K., and Crawford, H. L. First-order conditioning of meaning and the parallel conditioning of a GSR. *J. gen. Psychol.*, 1962, **67,** 159–167.

Staats, A. W., Staats, C. K., and Heard, W. G. Denotative meaning established by classical conditioning. *J. exp. Psychol.*, 1961, **61,** 300–303.

Staats, C. K., and Staats, A. W. Meaning established by classical conditioning. *J. exp. Psychol.*, 1957, **54,** 74–80.

Staats, C. K., and Staats, A. W. Attitude development and ratio of reinforcement. *Sociometry*, 1960, **23,** 338–350.

Triandis, H. C., and Osgood, C. E. A comparative factorial analysis of semantic structures in monolingual Greek and American college students. *J. abnorm. soc. Psychol.*, 1958, **57,** 187–196.

Zimmerman, D. W. Durable secondary reinforcement: Method and theory. *Psychol. Rev.*, 1957, **64,** 373–383.

22.

Verbal Mechanisms in Purpose and Set*[1]

Arthur W. Staats

Russell has very well posed the difficult problems in dealing with "purpose" and "set" within an objective framework. The conceptual and experimental difficulties are described, and alternative strategies are presented. This effort should rekindle interest in these areas of complex human behavior and should stimulate experimental or conceptual work which will attack the various problems.

Russell concludes that the consideration of the various theoretical frames indicates that, "There are a number of avenues along which investigation might proceed" (p. 269) and states, "It would . . . seem worthwhile to undertake research exploring the consequences of the laboratory manipulations usually associated with research on purpose in a more theoretically neutral fashion, using the experimental tasks that seem most likely to reflect the influence of any possible selective processes" (p. 269).

In the first part of my comments dealing with the complex topic of purpose, I would like to make a case for an S-R approach, and later describe some of my research which I think is relevant to the problem of set.

First, however, I would like to include myself among those whom Russell describes as teleophobic in attempting to "proceed with the investigation of variables untainted by purposive connotations" (p. 260), although I do not feel it is necessary, in a sense, to ignore the behaviors involved, hoping the problems will "aimlessly drift away." As Russell points out, "Perhaps no fact has provided more difficulty for systematic psychology than has the obvious one that behavior can frequently be described in terms of some conceived end toward which it is directed" (p. 260). It appears to me, however, that there are difficulties in addition to the complexity of the events involved. The additional problems stem from the terms and approaches which have been applied to the area, which still continue to survive, and which I think

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* This article by A. W. Staats appears under the title of "Comments on Professor Russell's Paper" in *Verbal Behavior and Learning* (C. N. Cofer and B. S. Musgrave, eds.), McGraw-Hill, 1963. Reprinted by permission of the author and McGraw-Hill.

[1] This work was supported by the Office of Naval Research under Contract Nonr-2794(02), by the Office of Education, Cooperative Research Program, under Contract 1048, and by the National Institute of Mental Health under Contract 2381(02).

obtrude their unproductive implications. For example, the terms "goal-directed," "goal-seeking," "behavior which occurs in order to achieve something," and so on, suggest that there is some influence by the goal itself—some future causality. A step away from this approach, with its obvious conflict with the demand for a demonstrable type of relationship between antecedents and consequents, is the idea that there is a "purpose" or "conception" or "intention" which precedes the behavior. This allows for an acceptable direction of causality but has mentalistic overtones, unless the antecedent variables are specified—and may be only one step away from a teleology if there is the implication that the as-yet-to-be-realized goal influences the intention. While it is true that Russell does not use the purposive terms with teleological connotations, I think that an analysis of the drawbacks in the use of such terms is productive here because of their implications for many people and because they are indeed unnecessary. The introduction of purposive terms does seem to include the goal as an event to be considered. And in relatively uncharted territory, depending upon how the problem is defined, different approaches and methods are indicated.

When the conceived end, or purpose, is considered as a behavior, however, other implications follow which are not mentalistic or teleological. The indication then is that the task is (1) reliably to describe the behavior involved, and (2) to establish the independent variables of which it is a function. In addition, (3) as a stimulus producing occurrence, a behavior can have a "causing" or "determining" status. That this is more than word magic will, I hope, be shown as we go on.

Russell describes several levels, or complexities, of behaviors with respect to a stimulus condition. Thus, there are simple reflexes and tropistic responses whose relation to the stimulus is clear. And he states, when describing an organism's approach response to the presence of a reinforcing stimulus, "As long as there is a plausible explanation for the occurrence of such behavior in terms of differential overt associative responses to objectively present, external stimuli, it would seem to add only an adjective to say that it was purposeful" (p. 262). It might help to add only that these occurrences are *best* described by referring to the *past* occasions where the organism's approach to the visual stimulus has been followed by reinforcement, e.g., the operations for producing a discriminative stimulus for an approach response. It might indeed detract here to use the term goal-directed since this suggests the improper method of examining the relationship of the goal, as a goal, to the behavior.

On the other hand, when the organism behaves in a manner described as looking for something which is not present, Russell feels that the term purposive is appropriately used. It is then that

> The behavior shown is more likely to be attributed to the operation of some state or mechanism within the organism, rather than to be interpreted as a simple case of differential responding to external stimuli. When such hypothesized states or mechanisms are attributed characteristics which force the organism to behave in such a way that the behavior is describable with reference to some anticipated end, then it would seem that the term purposeful could be significantly applied to the behavior so mediated (p. 262).

Thus Russell considers the term purposive as an inferred process of some type which mediates behavior. Whether the term can be productively or significantly applied in even this manner, however, is questionable.

Russell describes an example of this mechanism in the case of Professor Olson who gets up in the morning, drives on the route to his regular office, meets a road block, changes direction, detours through unknown streets until he meets a familiar route again, and arrives at the hospital where he has an appointment. This behavior can be termed purposeful—behavior in order to get to the hospital, behavior with an anticipated end, behavior which seeks the hospital, behavior under the control of a personal conception of the objective.

Russell adds that this type of description of Professor Olson's behavior does not provide an explanation of his actions but only clarifies what type of behavior will be considered under the term purposive. However, it does seem that some of the purposive terms tend to lead one away from consideration of the possible S-R processes involved and from the independent variables responsible for these processes. The hypothetical case of Professor Olson would not be so recondite if described in more detail in S-R terms. Upon arising in the morning Professor Olson opens his appointment book and texts the page for that day with the response, I HAVE TO BE AT SUCH AND SUCH HOSPITAL AT NINE O'CLOCK. I WONDER HOW I GET THERE. This verbal sequence then provides the stimulus controlling the responses of finding and scanning a map of the city. Tracing the route between his house and the hospital, he responds verbally, saying, TAKE MY USUAL ROUTE UNTIL I COME TO SEVENTH AVENUE. THEN RIGHT TO . . . etc., etc. Once in his car he drives for a time and then looks at the street signs, saying, I TURN RIGHT AT SEVENTH AVENUE. When the appropriate sign appears he texts it as SEVENTH AVENUE, and this verbal response then controls the motor response of turning the car to the right. The professor then drives until the roadblock appears. At this time he responds, I'LL GO SOUTH FOR A BLOCK AND THEN CONTINUE EAST SINCE THAT WILL PARALLEL THIS STREET AND EVENTUALLY GET ME TO HIGHLAND BOULEVARD WHICH TAKES ME TO THE HOSPITAL. He continues on, texts HIGHLAND BOULEVARD, turns toward the hospital, reaches the hospital, responds to the stimuli present by looking around, sees an open place at the curb, parks the car, goes into the hospital, looks around, texts the directory with DR. MORRIS, ROOM 329, and goes to this office in a still complicated sequence of verbal and motor behaviors.

Some of the texting responses involved in this sequence could be replaced by the individual's own verbal response sequences—and if the sequence occurred frequently enough, the behavior chain would occur without the support of the verbal behavior. That is, the motor behaviors involved, since they also produce certain visual stimuli (in some cases proprioceptive stimuli would be effective), would come to control the behaviors—thus, each motor behavior would result in arriving at a visual stimulus situation which would control the driving responses involved, and so on.

Although this is a hypothetical example, it seems to me, following this description, that the end or goal in this, or any situation of this type, would be irrelevant—and that use of purposive terms even in description of the behavior is misleading. If someone had placed a bomb in the office in which Professor Olson was to have the appointment—he would still go there. The determinants of Professor

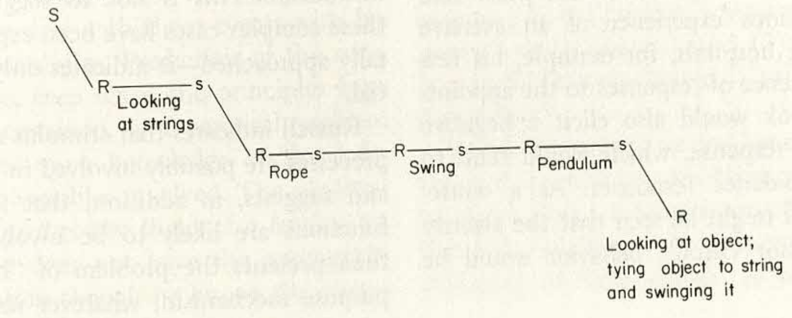
Olson's behavior are the past training circumstances concerned with the motor and verbal behaviors involved, and the manner in which they "mediate" the final behavior of entering the office.

The fact that the professor upon request could state that he was going to the hospital for an appointment would not change the situation. This behavior also is under the control of past events, actually the same ones as those which have already been mentioned. Certainly, this verbal behavior cannot be called the "goal" of the professor although it may enter into his getting to the hospital. It is simply verbal behavior under the control of the appointment book notation.

However, this is a very complex case, and perhaps an experimental example would be helpful here. Judson, Cofer, and Gelfand (1956) used Maier's two-string problem as the task for the subjects. Prior to being introduced to the problem, however, the subjects received pretraining on a separate learning task. This task involved learning lists of words in serial order. For one group of subjects the words ROPE, SWING, and PENDULUM were inserted in that order into one list. Thus, this group of subjects learned this sequence of word responses. Other groups of subjects did not learn these words in that manner.

It would be expected that the group of subjects for whom the response sequence ROPE-SWING-PENDULUM had been established, on encountering the Maier two-string problem, would tend to respond with ROPE (or STRING) to the cord involved in the problem. The response ROPE would produce stimuli which would elicit the response SWING, and SWING would elicit PENDULUM. It would also be expected that the sequence ROPE-SWING-PENDULUM would mediate the motor responses of constructing a pendulum, using the cord and swinging it. (A schematization of this is presented in Figure 1.) Thus, subjects who had this verbal sequence of responses established in good strength should be more likely to solve the problem. In general, the results of the experiment substantiated this prediction.

FIG. 1. Schematization of the Judson, Cofer, and Gelfand study of problem solving in which the stimulus of the instructions sets the occasion for the Ss response of looking at the strings. The visual stimulus of the strings tends to elicit the verbal response ROPE, which is the initial response in the previously established verbal chain ROPE-SWING-PENDULUM for experimental group Ss. This sequence then mediates the problem solving behaviors. From Staats: Verbal Mechanisms in Purpose and Set.



Although this is an experiment in reasoning or problem solving, the same elements are present as in the case of Professor Olson. The goal, or end, here is in reality the *present* instructions to tie the string together; these instructions perform a similar function as did Professor Olson's appointment book; that is, they mediate observing responses to the strings, etc., and the verbal and motor response sequences then unfold. This example indicates, I believe, that the purposive terms are misleading. The same events are studied without recourse to these terms or interest in the function of a goal.

The example of Professor Olson is much more complex in the training variables which must have been involved, in the controlling stimuli which were effective, and in the behavioral repertoires displayed. For example, each link in the verbal response sequences involved would be expected to be a hierarchy instead of a straightforward elicitation of the next response and no other. Thus, rather than as a smooth chain of verbal and instrumental responses, the chain would more realistically be described as showing the relative strengths of competing responses involved at each stimulus point. In addition, the picture of verbal behavior described is oversimplified, since it included only operant word responses and no mediating responses of the "meaning variety," which are developed under the principles of classical conditioning. If Professor Olson had had previous experience of an aversive nature at hospitals, for example, his textual sequence of responses to the appointment book would also elicit a negative meaning response, which would tend to elicit avoidance responses. As a consequence, it might be seen that the alacrity of Professor Olson's behavior would be missing.

The above is meant only to suggest that a description in terms of behavior principles can be made without resort to a purpose mechanism. As Russell points out, analyses of such "homely illustrations" do not constitute experimental hypotheses, but they can serve as a starting point. In this respect, however, since the above description is based upon principles which have arisen in controlled study, the nature of the independent variables underlying the complex purposive behavior is thereby suggested. That is, if one wishes to know how the individual responds verbally in a certain manner to the visual verbal stimuli in an appointment book, Skinner (1957) describes this; and there is ample evidence as to how visual discriminative operants are established and, specifically, how texts are formed according to the principles of reinforcement (Staats, Staats, Schutz, and Wolf, 1961). Since these textual responses themselves produce stimuli, the manner in which they can come to control motor behaviors should follow the same principles as those involved in bringing any behavior under stimulus control. And from a practical standpoint, if one is interested in developing purposive behavior, relevant training variables and verbal and motor repertoires are suggested. It is this which makes a description in terms of behavior principles more than an idle pastime or a retreat to mentalism. This is not to suggest that these complex cases have been experimentally approached—it indicates only potential.

Russell indicates that stimulus-response processes are possibly involved in purpose and suggests, in addition, that meaning functions are likely to be involved. He then presents the problem of "how the purpose mechanism, whatever its source and character, exercises its regulatory influence upon behavior" (p. 265).

On a general level, following from the previous S-R description, it could be said simply that the regulatory function occurs in the same manner as that in which any stimulus control occurs. That is, if what is called the purpose mechanism consists of chains of verbal and motor responses (some of which get the organism into new environmental stimulus conditions), then the resulting stimuli have the usual function in eliciting the final response.

In discussing this regulatory function, dealt with under the descriptive term set, Russell does describe Osgood's mediating response (1957) and Hull's fractional anticipatory goal response (1930). Russell suggests that study of these types of habit mechanisms may be one way of approaching the topic, but points out that Osgood's treatment has drawbacks.

> As plausible as Osgood's treatment may be, it has a technical difficulty that results from the very number of hypothesized stimulus sources which are considered. It is that even if the associative hierarchies of each stimulus source operating alone were known, there is still the problem of predicting the resultant when they are all simultaneously operating. Until this can be done with some accuracy, it will be difficult to test his predictions in complex cases (pp. 266–267).

However, the difficulty here seems to lie more with the complexity of the events under question, rather than with the attempt to deal with these events with behavior principles. Prediction of the complex case, even when the principles have been ascertained, is a practical problem and rests upon knowledge of the independent variables involved. The physicist cannot predict the flight of a feather because he does not have the appropriate information though he knows the principles which are operative. On the other hand, on the basis of the principles, he can manipulate independent variables to produce many important results.

The same types of possibilities are present in the areas of study under consideration. Although some complex set behaviors could not be predicted in everyday life because many unknown variables are operating, it is not unreasonable to expect that when the principles are well understood, it will be possible to manipulate variables to produce the desired behavior in this area.

Specific knowledge of the principles, of course, will stem from a piecemeal attack on the complex case, broken down and studied in the laboratory, as Russell points out. The question at this point is what basic principles and methods to apply in the laboratory study of set. Are behavior principles the most likely prospects for success in this task? I think so, and I would like to present several studies which we have conducted in a program of a piecemeal approach to one problem of set.

Russell describes sets in verbal learning and verbal behavior as "the manner in which the use of language is selectively directed, how certain verbal structures are 'tuned,' or 'primed,' how certain 'schemata,' are adopted, or how particular 'supraordinate categories' are activated" (p. 258). In Russell's description, it seems to me there are two separable types of events: (1) the "verbal structures," "categories," or "schemata"; and (2) the way in which these are "tuned," "primed," or "activated."

In our laboratory, we too have been interested in dealing with these two types of events, but we have approached these topics by working with the operant conditioning of word classes. A word class may be considered a verbal structure or category, and operant conditioning, in this case, can be considered in terms of its activating or tuning effect. Although the principle of operant conditioning has been frequently tested in the area of verbal behavior (see Krasner, 1958; Salzinger, 1959), the variables underlying the formation and function of the word classes or verbal structures involved (i.e., the set mechanisms) have received scant attention.

For example, in Salzinger's article summarizing studies of the operant conditioning of word classes, it is suggested that responses making up a word class are those which may be substituted for one another, are followed by the same reinforcement, or are emitted in the presence of the same discriminative stimulus. This does not appear (see Staats, 1961) to be an adequate rationale for the fact that the reinforcement of one word response strengthens other members of a class of words. Therefore, I would like to present what I consider to be a more detailed conceptual and experimental analysis which, at the same time, represents an analysis of a certain type of set.

Cofer and Foley (1942), Mowrer (1954), Osgood (1953), and Staats and Staats (1959) have discussed word meaning in terms of Hullian concepts as an implicit, mediating response. According to this interpretation, when a word is contiguously presented with a stimulus object, some of the unconditioned responses elicited by the object will be conditioned to the word. These responses when stably conditioned become the meaning of the word. First-order conditioning of meaning has been demonstrated by Staats, Staats, and Crawford (1958). Additional support for the contention that the concept of meaning may be treated as a conditioned response is given by a series of studies (Staats and Staats, 1957; Staats, Staats, and Heard, 1961) in which conditioning was accomplished by pairing a word which already elicited a meaning response with the verbal stimulus to be conditioned to elicit that meaning, i.e., a higher-order conditioning paradigm. Both connotative and denotative meaning responses were conditioned.

In addition, suggestions concerning the nature of the conditioned meaning response have been offered elsewhere (Osgood, 1953; Staats, 1961), and it will suffice to point out here that the conditioned response may be considered an autonomic response, an implicit motor response, or the conditionable portion of a sensory response. Thus, when a word is paired with an unconditioned stimulus eliciting a motor, autonomic, or sensory response, part of the response is conditioned to the word.

On the other hand, word responses also come under the control of stimulus objects, according to the principles of operant conditioning (Skinner, 1957). That is, a word response reinforced in the presence of a stimulus (and not in its absence) will come to be elicited (or controlled) by that stimulus. In this process, the word response comes to be elicited by the motor, autonomic, or sensory response produced by the stimulus (including those parts of the response which are conditionable as meanings). Thus a word as a stimulus-producing response comes to elicit a conditioned meaning response, but in addition, this same response comes to elicit the word response. This is depicted in Figure 2. The word BALL is elicited by the sensory response elicited by the object ball. In addition, BALL as a response elicits the conditionable parts of that sensory response.

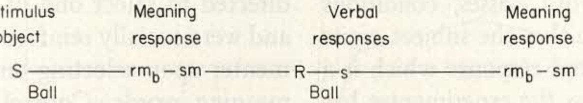


FIG. 2. The stimulus object ball elicits a sensory (meaning) response which, in the process of tacting, has come to elicit a verbal response BALL. The word BALL has been classically conditioned to elicit the same meaning response by being paired with the object ball. The object ball also elicits sensory responses which are not conditionable and which control the word response BALL, but this is not depicted. From Staats: Verbal Mechanisms in Purpose and Set.

At this point, the class of words consists of only one member. However, not only will the word BALL be reinforced in the presence of the stimulus object (or similar objects), but other responses will also be similarly treated, e.g., ROUND, CIRCULAR, SPHERICAL, ORANGE, BALLOON, and so on. Stimuli produced by these responses will also be paired with the objects in the classical conditioning of meaning. If in language learning, groups of words come to elicit the same meaning response component on the basis of being paired with the same or similar stimulus objects, and if the same meaning response component, through the stimuli it produces, comes to control the emission of each of the word responses in the class, then a mechanism would exist which would constitute a verbal structure or set on the basis of which operant conditioning of the class could occur. This verbal structure may be called a verbal habit family, using a Hullian-type terminology. The verbal habit family for "roundness" is schematized in Figure 3.

In the various studies of the operant

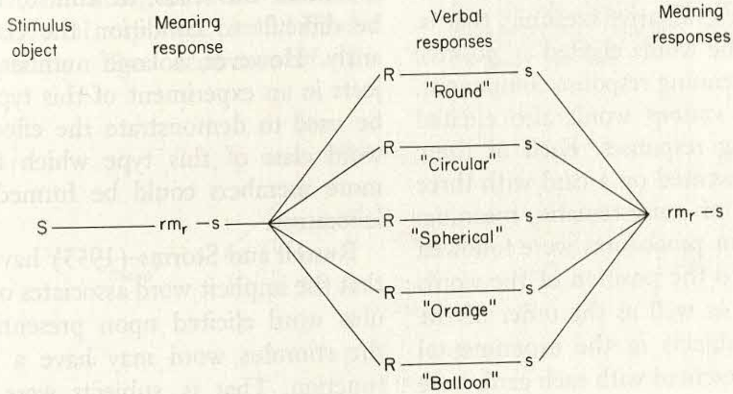


FIG. 3. A number of verbal responses have been operantly conditioned in the presence of the same or similar round objects which elicit the round meaning response. Thus, the verbal responses tend to be elicited by that round meaning component. The same word stimuli have also been paired with similar round objects and have come to elicit the round meaning response. Consequently, any object (or word) which elicits the round meaning response will tend to elicit the various verbal responses. This constitutes the verbal habit family for "roundness." From Staats: Verbal Mechanisms in Purpose and Set.

conditioning of word classes, conditions are manipulated so that the subject emits words. When a word response which is a member of the class the experimenter has chosen occurs, the experimenter presents some reinforcing stimulus. It is found that the frequency of the emission of the other members of the word class increases. This occurrence can be accounted for on the basis of the verbal habit family in the following manner. When the word response is reinforced, both the word response and the meaning response elicited by the word would be conditioned to the cues of the situation. However, since the meaning response component would also tend to elicit each of the word responses in the class, strengthening the tendency of the situation to elicit the meaning response would raise the probability that each of the word responses would be emitted. Each time one of the members of the class was emitted and reinforced, the strength of the habit family in that situation would, in this manner, be increased. This would not be the case for any word emitted in the situation and not reinforced, i.e., a nonclass word (Staats, 1961).

On the basis of this rationale, a study (Staats, Staats, and Finley, 1961a) was recently completed in which a group of 40 words was selected, each of which possessed positive evaluative meaning, that is, each one of the words elicited a "positive evaluative" meaning response component, although the various words also elicited other meaning responses. Each of these words was presented on a card with three other words of unsystematic meaning. Randomization procedures were followed with respect to the position of the words on the cards, as well as the order of the cards. The subjects in the experimental group were presented with each card, were directed to select one of the four words, and were socially reinforced by the experimenter upon selecting one of the positive meaning words. Control group subjects were not reinforced. Figure 4 presents the results, which indicate that a group of word responses, each of which elicited a common meaning response component, could be operantly conditioned as a class.

Consideration of the verbal habit-family model, however, leads to the expectation that any group of words which elicited a common response, if that response also tended to elicit each of the word responses, would condition as a class, i.e., be susceptible to set phenomena. An example of this may be found in the word-association norms of Russell and Jenkins (1954). The word SLEEP elicits BED, DREAM, COMFORT, and DEEP as associates to varying degrees. BED, DREAM, COMFORT, and DEEP in turn also elicit SLEEP. This response class is shown in Figure 5. Thus, it would be expected that reinforcing an individual every time he emitted one of the words that elicits SLEEP would strengthen the response SLEEP to the stimulus situation. The situational stimuli would thus tend to elicit SLEEP and thereby increase the probability that the associates to SLEEP would occur in the situation. Because of the few words involved in this class, of course, it would be difficult to condition the class operantly. However, a large number of subjects in an experiment of this type might be used to demonstrate the effect. Or a word class of this type which included more members could be formed in the laboratory.

Russell and Storms (1955) have shown that the implicit word associates of a stimulus word elicited upon presentation of the stimulus word may have a learning function. That is, subjects were able to

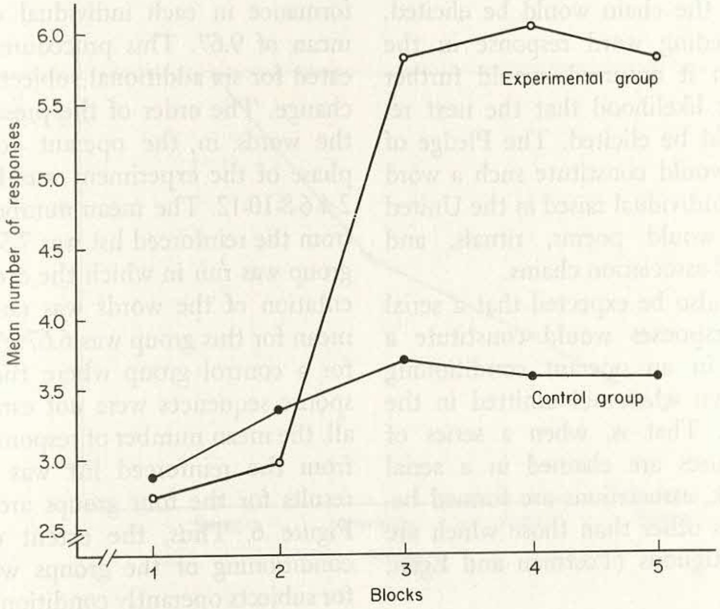
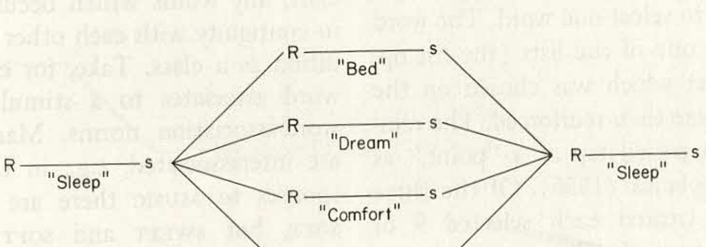


FIG. 4. The mean number of positive word responses for the five successive blocks of items for experimental and control group Ss. From Staats: Verbal Mechanisms in Purpose and Set.

acquire an A-D association, where A-B, B-C, and C-D associations already existed. It could thus be concluded that presentation of A tended to elicit B implicitly, B tended to elicit C, and C tended to elicit D.

On the basis of implicit chains of verbal responses, it would be expected that any serial chain of word associates, i.e., word responses, would demonstrate set characteristics in the operant conditioning situation. That is, if the first response in a chain were emitted, its word associates, the next several responses, would be elicited implicitly. The occurrence of reinforcement would then strengthen the tendency for all of the implicit responses to be elicited by the situation. If the next response in the chain occurred, the same process would be repeated and would make it even more likely that the third

FIG. 5. The "sleep" word response class. From Staats: Verbal Mechanisms in Purpose and Set.



response in the chain would be elicited. Each succeeding word response in the chain, when it occurred, would further increase the likelihood that the next response would be elicited. The Pledge of Allegiance would constitute such a word class for an individual raised in the United States, as would poems, rituals, and shorter word-association chains.

It would also be expected that a serial chain of responses would constitute a word class in an operant conditioning situation even when not emitted in the serial order. That is, when a series of word responses are chained in a serial learning task, associations are formed between words other than those which are directly contiguous (Postman and Egan, 1949).

However, the closer the order to that in the serial learning task, the stronger the associations would be and the greater the extent of operant conditioning expected.

These expectations were tested in the following study (Staats, Staats, and Finley, 1961b). The subjects separately learned two serial lists (two word response chains) by the paired-associate method of anticipation. The items on the lists were nonsense words, e.g., HUFOD, TEBAM, SOZOG. Later, the first words from each of the lists was placed upon one card, the two second words on another, and so on. Then, in the serial order, the cards were individually presented to the subject with instructions to select one word. The word responses in one of the lists (the list opposite to that which was chosen on the first card) were then reinforced. The reinforcer was a pencil tap as a "point," as used by Verplanck (1956). Of the three subjects so treated each selected 9 or more words from that list out of the possible 11—a statistically significant performance in each individual case—for a mean of 9.67. This procedure was replicated for six additional subjects with one change. The order of the presentation of the words in the operant conditioning phase of the experiment was 1-3-5-7-9-11-2-4-6-8-10-12. The mean number of words from the reinforced list was 7.50. Another group was run in which the order of presentation of the words was random. The mean for this group was 6.67. And finally, for a control group where the word response sequences were not established at all, the mean number of responses selected from the reinforced list was 5.67. The results for the four groups are shown in Figure 6. Thus, the extent of operant conditioning of the groups was greatest for subjects operantly conditioned in serial order, next greatest for subjects presented the alternate order, next for subjects receiving the random order, and least for the control subjects. A regression analysis of the treatment condition indicated a linear trend significant at the .005 level. That is, the conditionability of the class of word responses was dependent upon the strength of associations between the words. In other terms, it could be said that the effect of set depended upon the strength of associations. The serial training procedure produced a class of word responses for an operant conditioning situation.

In addition to this type of word response class, any words which occur frequently in contiguity with each other should condition as a class. Take, for example, the word associates to a stimulus word in word-association norms. Many of them are interassociated, e.g., in the word responses to MUSIC there are SWEET and SOFT, but SWEET and SOFT also elicit MUSIC. In addition the word LOUD, although not elicited by MUSIC, is elicited

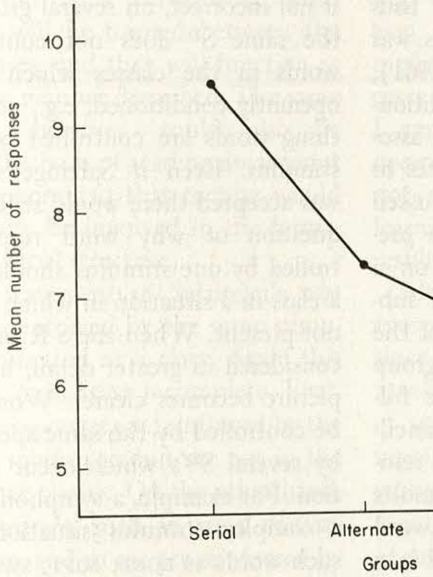
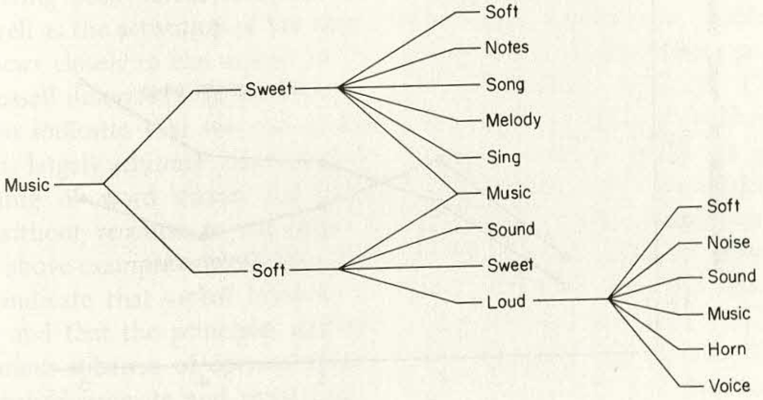


FIG. 6. Mean number of correct word responses for each of the serial learning study treatment groups. From Staats: Verbal Mechanisms in Purpose and Set.

by SOFT. Thus, LOUD would tend to occur as a response to MUSIC, since it is mediated by the response SOFT. Now LOUD as a stimulus word has as its associates a number of responses which are also direct associates to MUSIC, as well as the word MUSIC itself. This complex network of interrelated associations is illustrated in Figure 7. If complete word-association norms were available for these words, additional inter-associations would be seen.

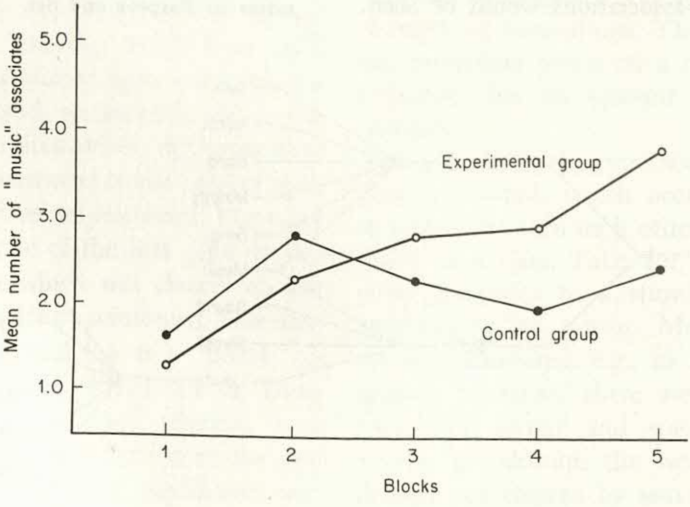
FIG. 7. Some of the interassociations established between the word associates to MUSIC. From Staats: Verbal Mechanisms in Purpose and Set.



Such a group of words should thus operantly condition as a class. This was tested (Staats, Staats, and Minke, 1961), using the methods of operant conditioning already described, for the word associates to MUSIC. That is, 25 associates to the word MUSIC were taken from Russell and Jenkins (1954), and each was presented with two nonmusic words on a card to two groups of subjects. All subjects were instructed to select one of the three words. In the experimental group the selection of a music word was followed by the reinforcement of the pencil-tap point, but no responses were reinforced in the control group. The results indicated that the number of MUSIC word responses significantly increased, and in a linear fashion ($p < .01$), for the experimental group relative to the control group. The results are shown in Figure 8.

On the basis of this evidence, which is not yet complete, it is now possible to analyze this aspect of the problem of set in greater detail. Salzinger stated that word classes are formed when the same discriminative stimulus controls the various words. This statement is incomplete, if not incorrect, on several grounds. First, the same S^D does not control all the words in the classes which have been operantly conditioned; e.g., not all living-thing words are controlled by the same stimulus. Even if Salzinger's statement was accepted there would still remain the question of why word responses controlled by one stimulus should behave as a class in a situation in which this S^D was not present. When the S-R principles are considered in greater detail, however, the picture becomes clearer. Words may not be controlled by the same specific S^D but by several S^D's which occur in conjunction. For example, a symphony concert is a complex stimulus situation in which such words as LOUD, SOFT, SWEET, MUSIC, HORN, NOTES, MELODY, and so on, are likely to occur, controlled by the various

FIG. 8. Mean number of MUSIC associates emitted in each block of five trials for experimental and control group Ss. The experimental Ss were reinforced upon each emission of an associate to MUSIC, while none of the responses of the control Ss were reinforced. From Staats: Verbal Mechanisms in Purpose and Set.



specific stimuli. As a consequence, word associations will be formed between the word responses, and they will function as a class in the manner described. The same associations, however, could also be formed on the basis of reading an account of the symphony, so that tacting would not necessarily be involved in the formation of the verbal structure.

Another statement of Salzinger's was that words reinforced by the same stimulus would function as a class. Again this is incorrect, or at least incomplete. First, many word responses are reinforced by the same social reinforcers but are not in the same response classes. On the other hand, food-word mands, such as MILK PLEASE, BREAD PLEASE, and so on, are reinforced by different stimuli and yet they are in the same class. In the terms developed herein, however, the interpretation of the development of this class of words might be that salivation would come to elicit all food words and be elicited by all of them —thus, forming a verbal habit family. On this basis, a class of food words should be capable of operant conditioning.

I have used a particular research series to demonstrate the application of S-R principles and methods to the problems of set. The problem is one in verbal learning, involving both verbal structure (or set), as well as the activation of the structure; it hews closely to the aspects of set which Russell describes. The problem selected also indicates that the use of the term set is largely arbitrary, since operant conditioning of word classes has been studied without recourse to the term. I hope the above examples also additionally serve to indicate that verbal behavior is one field and that the principles studied in the various subareas of operant conditioning, paired-associate and serial learning, word-association norms and mediation, and semantic conditioning and mediation are all operative when complex cases are considered in detail. Especially, I am interested in indicating that the operant conditioning of word classes is not a new and separate area in verbal learning. It depends upon principles and results available in other fields.

Although the complex behavior in everyday life may be difficult to predict since a number of S-R mechanisms are involved, the mechanisms may be capable of separation and thus be susceptible to investigation in the laboratory. Such investigation, on the other hand, should eventually yield the customary products of prediction and control.

I don't wish to give the impression that the research summarized is the only or the first attempt to attack the various problems of set with S-R principles. A number of other studies furnish the same type of evidence. For example, using anagrams and water-jar problems, Maltzman and associates (1953) have indicated that Hullian concepts of response hierarchies and drive are applicable in indicating some of the characteristics of the selective mechanisms. Maltzman and associates (1958), in addition to another study using the two-string problem (Staats, 1955), have shown that verbal responses to problem-solving objects are an index of later performance in the problem. Adamson (1959) has shown that schedule of reinforcement of anagram solutions affects the persistence of the solution (i.e., the rigidity of set). And the S-R verbal mechanisms involved in a number of verbal set behaviors have been studied by Bousfield and associates and Cofer and associates (see Bousfield, 1953; Bousfield and Cohen, 1953; Bousfield, Whitmarsh, and Berkowitz, 1958;

Judson and Cofer, 1956; and Havron and Cofer, 1957).

On the basis of these demonstrations, I would suggest a redefinition of the problems of set and purpose which would deny a special mechanism, or category of behavior. While recognizing the need to deal with complex behaviors of the type described by Russell, it seems that S-R principles will suffice. In these terms, the problem is first an adequate description of the behaviors involved, second an analysis of the S-R mechanisms, and third a laboratory isolation and simplification of the interacting mechanisms. Certainly, S-R principles are potentially, at least in combination, capable of the complexity seen in human behavior in everyday life. That is, stimulus events vary in type (i.e., exteroceptive, interoceptive, and proprioceptive) and are capable of variations in the strength with which they elicit or control responses. Chains or sequences of behavior are capable of extensions in terms of the number and types of units involved, and the individual units are capable of combination into hierarchies. Thus, there may be hierarchies of stimuli which elicit chains of responses which mediate hierarchies of other responses. In addition, verbal behaviors, as one type of response, allow for the long-term direction of behavior which leads to labels of "purposive," and so on. Although there are infinite variations in complex human behaviors, the S-R mechanisms which have already been established are capable of combination into infinitely varied arrangements.

One further point. As Russell points out in mentioning teleophobia, purposive terms and the behavior involved have been excluded by many S-R investigators as legitimate areas of study. In fact, because of the mentalistic misuse of such terms as meaning, images, thinking, and even some types of overt language behaviors, such events were also rejected as appropriate subject matter for study. And possibly rightly so, since events which cannot be approached objectively should perhaps be overlooked in favor of more simple and basic events. Probably early experimental approaches to behavior could handle only simple behaviors with simple organisms. However, as time passes, behavioristic psychology, building upon the more basic principles, has already objectively approached some of these formerly taboo areas, as well as the area under discussion—and with success. The progression of this approach has been in the best tradition of science, beginning with the more simple events investigated in well-controlled circumstances, and advancing to consideration of the more complex cases as methodology develops. Because of this history, and the well-established principles which have been produced, when there is a choice concerning which methodology and principles seem most applicable to a new area of behavior, it seems reasonable to apply first those of the S-R approach.

REFERENCES

Adamson, R. (1959) Inhibitory set in problem solving as related to reinforcement learning. *J. Exp. Psychol.*, **58,** 280–282.

Bousfield, W. A. (1953) The occurrence of clustering in the recall of randomly arranged associates. *J. Gen. Psychol.*, **49,** 229–240.

Bousfield, W. A., & Cohen, B. H. (1953) The effects of reinforcement on the occurrence of clustering in the recall of randomly arranged associates. *J. Psychol.*, **36,** 67–81.

Bousfield, W. A., Whitmarsh, G. A., & Berkowitz, H. (1958) Partial response identities in associative clustering. *Tech. Rep. No.* 27. Contract No. Nonr-631(00), Office of Naval Research and University of Connecticut.

Cofer, C. N., & Foley, J. P. (1942) Mediated generalization and the interpretation of verbal behavior: I. Prolegomena. *Psychol. Rev.*, **49,** 513–540.

Havron, M. D., & Cofer, C. N. (1957) On the learning of material congruent and incongruent with attitudes. *J. Soc. Psychol.*, **46,** 91–98.

Hull, C. (1930) Knowledge and purpose as habit mechanisms. *Psychol. Rev.*, **37,** 511–525.

Judson, A. J., & Cofer, C. N. (1956) Reasoning as an associative process: I. "Direction" in a simple verbal problem. *Psychol. Rep.*, **2,** 469–476.

Judson, A. J., Cofer, C. N., & Gelfand, S. (1956) Reasoning as an associative process: II. "Direction" in problem solving as a function of prior reinforcement of relevant responses. *Psychol. Rep.*, **2,** 501–507.

Krasner, L. (1958) Studies of the conditioning of verbal behavior. *Psychol. Bull.*, **55,** 148–170.

Maltzman, I., Brooks, L. O., Bogartz, W., & Summers, S. S. (1958) The facilitation of problem solving by prior exposure to uncommon responses. *J. Exp. Psychol.*, **56,** 399–406.

Maltzman, I., Fox, J., & Morrisett, L., Jr. (1953) Some effects of manifest anxiety on mental set. *J. Exp. Psychol.*, **46,** 50–54.

Mowrer, O. H. (1954) The psychologist looks at language. *Amer. Psychologist*, **9,** 660–694.

Osgood, C. E. (1953) *Method and theory in experimental psychology.* New York: Oxford.

Osgood, C. E. (1957) Motivational dynamics of language behavior. In M. R. Jones (Ed.), *Nebraska Symposium on Motivation.* Lincoln, Nebr.: University of Nebraska Press. Pp. 348–424.

Postman, L., & Egan, J. P. (1949) *Experimental psychology: An introduction.* New York: Harper.

Russell, W. A., & Jenkins, J. J. (1954) The complete Minnesota norms for responses to 100 words from the Kent-Rosanoff Word Association Test. *Tech. Rep. No. 11*, Contract No. N8onr-66216, Office of Naval Research and University of Minnesota.

Russell, W. A., & Storms, L. H. (1955) Implicit verbal chaining in paired-associate learning. *J. Exp. Psychol.*, **49,** 287–293.

Salzinger, K. (1959) Experimental manipulation of verbal behavior: A review. *J. Gen. Psychol.*, **61,** 65–94.

Skinner, B. F. (1957) *Verbal behavior.* New York: Appleton-Century-Crofts.

Staats, A. W. (1955) A behavioristic study of human problem solving. Ph.D. dissertation, University of California, Los Angeles.

Staats, A. W. (1961) Verbal habit-families, concepts, and the operant conditioning of word classes. *Psychol. Rev.*, **68,** 190–204.

Staats, A. W., & Staats, C. K. (1959) Meaning and (m): Separate but correlated. *Psychol. Rev.*, **66,** 136–144.

Staats, A. W., Staats, C. K., & Crawford, H. L. (1962) First-order conditioning of word meaning. *J. gen. Psychol.*, **67,** 159–167.

Staats, A. W., Staats, C. K., & Finley, J. R. (1961a) Operant conditioning of a semantically identified word class. *Tech. Rep. No. 14*, Contract No. Nonr-2794(02), Office of Naval Research and Arizona State University.

Staats, A. W., Staats, C. K., & Finley, J. R. (1961b) Operant conditioning of serially-chained verbal responses. *J. gen. Psychol.*, in press.

Staats, A. W., Staats, C. K., & Heard, W. G. (1961) Denotative meaning established by classical conditioning. *J. Exp. Psychol.*, **61,** 300–303.

Staats, A. W., Staats, C. K., & Minke, K. A. (1961) Operant conditioning of a class of word associates. *J. gen. Psychol.*, in press.

Staats, A. W., Staats, C. K., Schutz, R. E., and Wolf, M. (1961) The conditioning of textual responses utilizing "extrinsic" reinforcers. *J. exp. anal. Behav.*, **5,** 33–40.

Staats, C. K., & Staats, A. W. (1957) Meaning established by classical conditioning. *J. Exp. Psychol.*, **54,** 74–80.

Verplanck, W. S. (1956) The operant conditioning of human motor behavior. *Psychol. Bull.*, **53,** 70–83.

chapter **V**

Problem Solving

It is difficult to sample experimental procedures which are representative of a learning approach to human problem solving. There have been many diverse experimental situations in which problem solving has been studied—even within the learning framework. A solution to the problem of presenting a discussion which has generality may be gained by presenting several theoretical formulations which include summaries of experimental research. In these formulations again we find that several different learning approaches and experimental methods come into integration, that is, the Hullian, Skinnerian, and "word-associational" approaches. It is interesting to see in this instance how well the approaches may be related when the idiosyncratic language features are minimized and the empirical principles of learning are used as the model.

Maltzman, in the first article, discusses human problem solving in terms of compound habit families. In doing so he suggests that the elementary laws of behavior should also apply to this complex human behavior. Thus, principles such as reinforcement, extinction, primary and mediated generalization, and so on, should function in the individual's problem solving activities. Although Maltzman couches his statements in the theoretical concepts of Hull, for example, habit strength ($_SH_R$), reactive inhibition (I_r), and so on, it will be seen in the articles to follow, as well as those which have already been presented, that the enduring concepts which survive in the application of learning principles to human learning seem to derive from the elementary empirical behavior principles.

Kendler and Kendler present a learning view of human problem solving which also derives from the same sources but which confines itself to basic terms. This formulation is also based upon experiments in which the elements are more clearly shown than in many complex problem solving situations. These authors emphasize the role of mediating responses in their analysis and marshall evidence in the support of the contention that mediating responses are involved in the problem solving behaviors of articulate humans. This formulation includes emphasis upon the importance of language in problem solving.

Maltzman in the next article also considers problem solving to involve situations which elicit a hierarchy of responses in the individual, with the solution-response having only very low strength. Originality may be considered in the same terms, as behavior which is infrequent under existing conditions but which is appropriate to those conditions. Working within the context of unusual word associations, Maltzman in this paper considers the general behavior of being original as subject to the principles of learning. He summarizes a series of his experiments which substantiate the proposition that procedures which induce and reinforce original behavior will result in the generalization of originality to other situations.

In the philosophy of the British Empiricists great emphasis was placed upon the association of "ideas." The mentalistic term *idea* was not fruitful in an explanatory sense, but later with the advent of experimental psychology individuals began to study the results of procedures of "association." The field of verbal learning, which included the development of the memory drum and experiments in paired associate and serial learning, has meticulously studied some of the learning variables involved. The excerpt from Mednick's article (as well as aspects of the preceding article of Maltzman) is in the tradition of this approach to human learning, utilizing the concepts of word association structures to discuss creativity in problem solving. He considers creativity of response to involve the complexity of word response hierarchies elicited by a stimulus situation, as well as the lack of extremely dominant responses in the hierarchy.

Verplanck applies the terminology and methods of operant conditioning to certain aspects of problem solving and clearly illuminates some of the traditional problems in this area of study. He begins his experimental quest in dissatisfaction with terms like *awareness, hypotheses*, and so on, which are used as pseudo-explanations of problem solving. Verplanck treats the verbal statements which subjects habitually make in problem situations as operant behaviors. In doing so problem solving is characterized to include chains of verbal responses, some of which are under the control of the problem solving objects, and some of which may control further problem solving behaviors. Verplanck's experiments are notable in making directly observable the types of mediating verbal responses which are only indirectly studied in most other experiments on problem-solving.

Abstracting from these various formulations, it might be stated that verbal responses under the control of the problem solving objects are initially important. Furthermore, the subsequent verbal associations (intraverbals), which the initial verbal responses control, constitute the second link important to problem solving. Finally, these verbal associates may control terminal verbal or nonverbal problem solving behaviors. At any step of the chain, hierarchies of responses may be involved, rather than single responses. In the complex problem solving which occurs in everyday life these chains could be expected to be extremely intricate both in length of chain as well as complexity of hierarchical structure.

23.

Thinking: From a Behavioristic Point of View[*][1]

Irving Maltzman

Hull (10) has demonstrated that the habit family hierarchy and related principles may generate many hypotheses concerning behavior in relation to objects in space such as might occur in the *Umweg* problem or simple kinds of novel behavior. He has thus shown that the elementary laws of behavior may be applicable to behavior of non-speaking organisms in so-called reasoning situations.

The purpose of this paper is to demonstrate that the principles formulated by Hull and by Spence may also be applicable to the problem solving of articulate humans. In this respect the present analysis has much in common with the important formulations concerning mediated generalization and problem solving by Cofer and his associates (2, 3), Dollard and Miller (5), Doob (6), and Osgood (19). The behavior theory involved may be outlined as follows. Behavior is a function of effective reaction potential ($_{S}E_{R}$), which in turn is a multiplicative function of habit strength ($_{S}H_{R}$) and the effective drive state (D) minus the total inhibitory potential (I_{R}). The latter represents the summation of reactive (I_{r}) and conditioned ($_{S}I_{R}$) inhibition. It is assumed here that the effective drive state represents the summation of the anticipatory goal response (rg-sg) as well as the primary and secondary drives (23). Furthermore, the multiplicative effect of the anticipatory goal response is restricted to its associated class of instrumental responses.

The principal theoretical conception necessary for our account of problem solving is an extension of Hull's spatial habit family hierarchy (9, 10). The great complexity of human thinking requires the formulation of what might be called compound temporal habit family hierarchies. In the spatial habit family hierarchy, alternative locomotor responses are elicited as a function, in part, of spatial and temporal distance from a goal. But in adult human problem solving, responses in changing spatial relations to a goal are not usually elicited, although there are problems involving motor skills in which this may be the case. A typical performance change in problem solving is in terms of verbal responses, and the change is solely a temporal one (4). Nevertheless, it is assumed that the principles operating in the spatial habit family hierarchy will to a large extent operate in the temporal hierarchy. Recent evidence in support of this assumption has been obtained by Rigby (21).

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[*] From I. Maltzman, Thinking: from a behavioristic point of view, *Psychol. Rev.*, **62,** 275–286 (1955). Reprinted by permission of the author and the American Psychological Association.

[1] Portions of this paper were presented in a symposium on "Future Trends in Problem Solving" held at the 1954 meetings of the Western Psychological Association.

The conception of a compound temporal habit family hierarchy is based upon the prior assumption that the elementary laws of behavior derived from conditioning and applicable to trial-and-error and discrimination learning are also applicable, at least in part, to primary problem solving or reasoning, and thinking in general. That different kinds of behavior are observed in conditioning, trial-and-error, discrimination, and problem-solving situations is not to be denied. But these different behaviors need not necessarily involve fundamentally different laws. Different behavior is observed in these situations because the initial conditions are different, and the situations represent varying degrees of complexity in the sense of the number of different variables and principles operating in them. Nevertheless, it is reasonable to assume that at least some of the elementary laws derived from conditioning will lead to the development of the composition laws operating in human problem solving.

As Hull (10) has demonstrated, these elementary laws can account for many of the phenomena of simple trial-and-error learning. A hierarchy of responses elicitable by a given stimulus, in which the correct response is relatively low in the hierarchy, characterizes this form of behavior, as shown in Fig. 1. Learning is said to be complete when the order of the response hierarchy has so changed that the correct response is now dominant in the hierarchy. Hull has called this hierarchy of responses, elicitable by a given class of stimuli, the divergent mechanism (9).

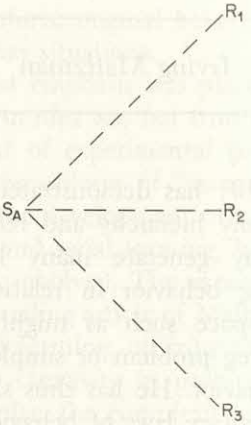

FIG. 1. A divergent mechanism. The stimulus has varying tendencies to elicit the alternative responses· From Maltzman: Thinking: From a behavioristic point of view.

As Spence (22) and Hull (10) have demonstrated, the elementary laws of behavior derivable from conditioning situations can also account for many of the phenomena of simple discrimination learning. A hierarchy of stimuli eliciting a given response in which the correct cue is relatively low in the hierarchy characterizes this form of behavior, as shown in Fig. 2. Such learning is said to be complete when the order of the stimulus

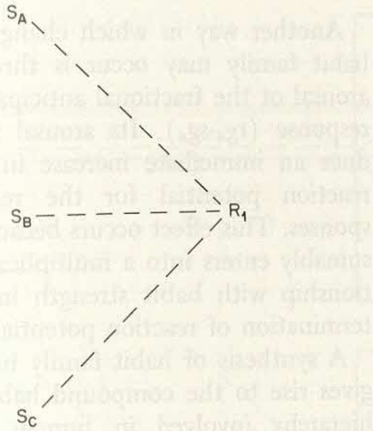

FIG. 2. A convergent mechanism. The alternative stimuli have varying tendencies to elicit a given response. From Maltzman: Thinking: From a behavioristic point of view.

hierarchy has so changed that the correct cue is dominant. Hull has called this hierarchy of stimuli eliciting a given response the convergent mechanism (9).

A synthesis of the divergent and convergent mechanisms gives rise to the habit family hierarchy involved in behavior sequences in relation to objects in space (9, 10). A hierarchy of this sort is shown in Fig. 3.[2]

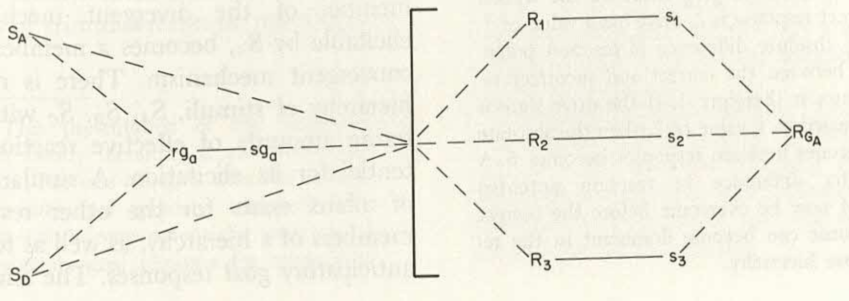

FIG. 3. A habit family hierarchy produced by a divergent and a convergent mechanism. From Maltzman: Thinking: From a behavioristic point of view.

As seen in this figure, S_A (the external stimulus) and S_D (an internal drive stimulus) are capable of eliciting a given habit family hierarchy and equivalent responses leading to a given goal. Common to all responses in the hierarchy is a fractional anticipatory goal response (rg_a-sg_a) which is associated with both the external and internal sources of stimulation. Responses in the hierarchy may be elicited directly by either the external or internal stimuli, or by both. The effects of reinforcement or extinction of individual members of the hierarchy generalize to other members through the mediating mechanism of the anticipatory goal response and its stimulus. It therefore follows that the principles of conditioning and trial-and-error learning should also apply, at least in a general way, to the habit family hierarchy.

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[2] There have been a few minor deviations from Hull in the manner of diagramming the stimulus-response relationships in order to simplify their presentation. Instead of having a dashed line between the stimulus and each response member of the divergent mechanism, a single dashed line leading to a bracket is used. All bracketed responses are associated with the stimulus. The number and length of the response sequences have also been reduced. A dashed line between a stimulus and a response signifies a learned association, while a solid line between a response and the cue it produces indicates an unlearned association.

For example, if the reaction potential of the correct response leading to a goal is low in the hierarchy, then the generalized conditioned inhibition from the repeated failures of the dominant incorrect responses may reduce its effective reaction potential below the response threshold. Attainment of the goal would never occur under the conditions present. Or, if the subject has a high degree of an irrelevant need such as anxiety, aside from the possible interfering effects coming from the competing responses aroused by this drive, failure to attain the goal under the above conditions would be even more pronounced. The increased effective drive state multiplying the habit strengths for the dominant incorrect responses and the weak correct responses would increase the absolute difference in reaction potential between the two.[3] Such a condition would produce a greater amount of conditioned inhibition generated through the repeated extinction of incorrect responses. This in turn would increase the probability of failure.

Another way in which changes in the habit family may occur is through the arousal of the fractional anticipatory goal response (r_{g_a}-s_{g_a}). Its arousal may produce an immediate increase in effective reaction potential for the related responses. This effect occurs because it presumably enters into a multiplicative relationship with habit strength in the determination of reaction potential.

A synthesis of habit family hierarchies gives rise to the compound habit family hierarchy involved in human problem solving. A hierarchy of this sort is shown in Fig. 4. It is formed when the stimulus of a divergent mechanism becomes a member of a convergent mechanism as well. By the same learning process, responses of the divergent mechanism in question become responses in convergent mechanisms. In the compound habit family hierarchy not only does S_A have the disposition for arousing its habit family hierarchy, but to varying degree the habit family hierarchies of S_B and S_C as well. There is a hierarchy of habit families elicitable by S_A. An analogous condition holds for the other stimulus complexes, S_B and S_C. They have varying amounts of reaction potential for the elicitation of the other habit family hierarchies. These relations as well as the drive stimuli have been omitted in Fig. 4, in order to avoid confusing details.

When the compound hierarchy is formed, R_1, for example, originally only a member of the divergent mechanism elicitable by S_A, becomes a member of a convergent mechanism. There is now a hierarchy of stimuli, S_A, S_B, S_C with differing amounts of effective reaction potential for its elicitation. A similar state of affairs exists for the other response members of a hierarchy, as well as for the anticipatory goal responses. The stimulus

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[3] For illustrative purposes we may substitute numerical values in the formula for reaction potential ($_SE_R = {_SH} \times D$). The $_SH_R$ value for the dominant incorrect response is 5; the $_SH_R$ value for the weaker correct response is 2; drive has a value of 1. The absolute difference in reaction potential between the correct and incorrect responses is therefore 3. If the drive state is increased to a value of 2, then the absolute difference between responses becomes 6. A greater difference in reaction potential must now be overcome before the correct response can become dominant in the response hierarchy.

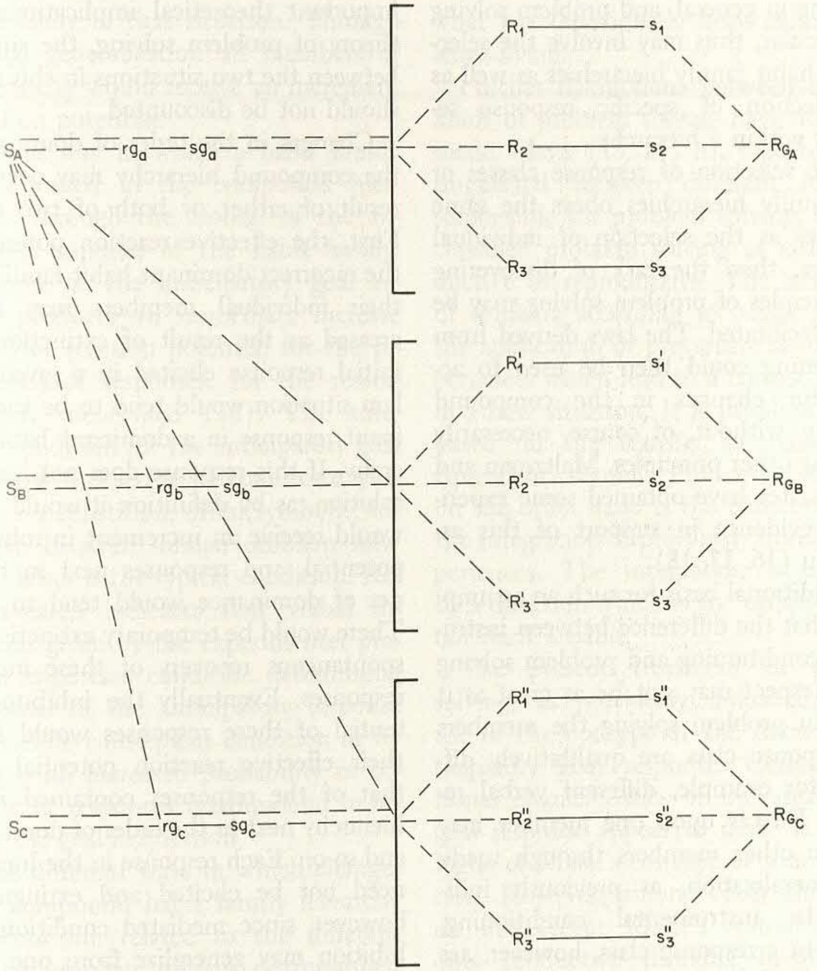

FIG. 4. A compound habit family hierarchy produced by a combination of habit family hierarchies. From Maltzman, Thinking: From a behavioristic point of view.

complex S_A has varying amounts of reaction potential for the elicitation of the anticipatory goal response r_{g_b}-s_{g_b} and r_{g_c}-s_{g_c} as well as its original anticipatory response. We now have a hierarchy of habit family hierarchies or a class of classes of stimulus-response relationships.[4]

Theories of problem solving by Duncker (7), Duncker and Krechevsky (8) and by Wolters (25), although stemming from different points of view, have a number of characteristics in common with the compound habit family hierarchy.

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[4] This presentation of the compound habit family hierarchy is an oversimplification. For one thing, it does not indicate that individual response members of a habit family may potentially serve as the anticipatory goal response for other habit families. Also, the stimulus aspects of the compound hierarchy, and how they are related to concept formation and perception, are not developed here.

Thinking in general, and problem solving in particular, thus may involve the selection of habit family hierarchies as well as the selection of specific response sequences within a hierarchy.

If the selection of response classes or habit family hierarchies obeys the same principles as the selection of individual responses, then the task of discovering the principles of problem solving may be greatly facilitated. The laws derived from conditioning could then be used to account for changes in the compound hierarchy, without, of course, necessarily excluding other principles. Maltzman and his associates have obtained some experimental evidence in support of this assumption (16, 17, 18).

An additional basis for such an assumption is that the difference between instrumental conditioning and problem solving in this respect may not be as great as it seems. In problem solving the members of a response class are qualitatively different—for example, different verbal responses. Effects upon one member may influence other members through mediated generalization, as previously indicated. In instrumental conditioning, changes in a response class, however, are also involved, because precisely the same response may not occur on successive trials (10). There are differences in intensity and, perhaps, in quality in the successive bar-pressing responses in the Skinner box. Nevertheless the rate of bar pressing increases with successive reinforcements. Learning occurs even though a given response is not precisely repeated, because a class of similar responses is reinforced as a result of simple stimulus and simple response generalization. The limits and the precise manner in which generalization occurs in the two situations are probably different. But because of its important theoretical implications for a theory of problem solving, the similarity between the two situations in this respect should not be discounted.

Changes in the order of dominance in the compound hierarchy may occur as a result of either or both of two effects. First, the effective reaction potential of the incorrect dominant habit families and their individual members may be decreased as the result of extinction. The initial response elicited in a given problem situation would tend to be the dominant response in a dominant habit hierarchy. If this response does not lead to a solution, as by definition it would not, it would receive an increment in inhibitory potential, and responses next in the order of dominance would tend to occur. There would be temporary extinction and spontaneous recovery of these incorrect responses. Eventually the inhibitory potential of these responses would reduce their effective reaction potential below that of the responses contained in the hierarchy next in the order of dominance, and so on. Each response in the hierarchy need not be elicited and extinguished, however, since mediated conditioned inhibition may generalize from one member of a hierarchy to another. The anticipatory goal response of this hierarchy presumably would also acquire inhibitory potential, thereby further reducing the effective reaction potential of the related class of responses.

A second general way in which changes in the order of dominance in a compound hierarchy may occur is by increasing the effective reaction potential of the habit family or families initially low in the hierarchy which contain the correct responses. One way in which this may come about is as a result of previous reinforcement of individual members of the hierarchy in that situation. Through mediated generalization all members of the hierarchy would receive an increment in reaction potential.

Another way in which a habit family may be raised in the compound hierarchy is through the arousal of the anticipatory response of the habit family. Elicitation of the anticipatory goal response produces an immediate increase in effective reaction potential for the related class of responses, for the reason previously mentioned (15). The antecedent condition for the anticipatory goal response is assumed to be commerce with a goal or a substitute, often symbolic, for the goal. In adult human problem solving the latter is the typical condition. Recent research indicates that verbal instructions given by the experimenter provide an important condition determining the arousal of the anticipatory response (2, 15). The consequent condition of its arousal is an increased probability of occurrence of responses instrumental in attaining the goal in question.

These different ways in which changes in the compound habit family hierarchy may occur are related to the different kinds of problem solving distinguished by certain writers. As Hull (10) has pointed out, any learning situation other than classical conditioning involves problem solving of some sort. The essential characteristics of a problem-solving situation are that an organism is motivated, and that attainment of some goal object satisfying that drive is dependent upon the organism's performing in a given manner. It is characteristic of problem solving that the appropriate response leading to goal attainment does not immediately occur. This is true to some extent in instrumental conditioning, and to a greater extent in trial-and-error learning and in what has traditionally been called problem solving.

Further distinctions between different kinds of problem solving have also been made. Maier (13, 14) has repeatedly distinguished between different functions responsible for problem solving, and has classified problem solving as either productive or reproductive. The latter kind of thinking according to Maier involves the application of previously acquired experiences which lead to a correct solution in a new situation. It is problem solving based on the transfer of training, or equivalent stimuli. Productive thinking on the other hand is the consequence of the integration of previously unrelated experiences. The integration is produced by a direction which is an "outside" force not itself a habit.

The present treatment of problem solving, as previously indicated, makes use of the concept of the fractional anticipatory goal response. Certain functional characteristics of the anticipatory goal response appear to make it an analogue of Maier's concept of a new direction. However, among other things, we do not accept Maier's restriction that only productive thinking involves the combination of previously isolated habit segments, to use Hull's terminology. To some extent this is the distinguishing characteristic of all thinking. It is the feature that sets it off from simple retention, and trial-and-error learning. All forms of thinking involve mediated generalization, and hence compounding of previously isolated habit segments.

Nevertheless, there are differences between reproductive and productive thinking. Situations eliciting reproductive thinking often involve the presentation of a succession of problems. The solution of each of these requires the elicitation of different response members of the same habit family hierarchy. This habit family will then become dominant in the compound hierarchy, as the result of reinforcement of its response members and the extinction of responses belonging to different habit families. As previously indicated, the increase in reaction potential of the entire class of responses as the result of reinforcement of individual members would occur as a consequence of mediated generalization. For example, subjects given a series of anagrams whose solutions all belong to the same word category will have a greater frequency of success on subsequent anagrams of the same category than subjects without such prior experience (20). However, failure on individual problems may occur because a solution is still dependent upon selection of particular responses within this one habit family.

The occurrence of reproductive thinking in situations where only a single problem is presented is also the consequence of the factors outlined. As a result of past training the dominant habit family in the compound hierarchy contains the correct response. Solution of the given problem depends upon extinction of the initially dominant incorrect responses within this one hierarchy.

In productive thinking, on the other hand, a habit family initially low in the compound hierarchy must become dominant before a correct solution can be attained. This occurs as the result of the extinction of the dominant incorrect response hierarchies. Once the appropriate habit family is dominant a solution will occur, provided that the correct responses within that hierarchy in turn become dominant. The protocols of subjects in Duncker's radiation problem exemplify this mode of thinking (7).

If a subject incorrectly anticipates the goal or solution to the problem—e.g., "destroy the tumor by means of rays sent over a path as free as possible from healthy tissue"—the proposed solutions are alternative responses within the same dominant habit family, and are all attempts to achieve this end. Repeated failure of these proposals will produce extinction of the anticipatory goal response and its related instrumental responses. As a consequence, another habit family may become dominant. The subject will now anticipate a different kind of solution, such as "reduce the intensity of radiation." As a result, all potential response sequences in the subject's habit family leading to this goal are facilitated. If the correct solution (converging rays from different angles) is not the dominant response in this hierarchy, extinction of incorrect responses must occur before the solution will be attained.

In an actual protocol this orderly progression from one habit family to another is probably an infrequent occurrence. The more typical case would be one in which the reaction potentials of two or more habit families overlap. This would probably be the case after the first few responses from the dominant hierarchy have been extinguished. Thus reproductive and productive thinking differ with respect to the kinds of changes which must occur in the compound hierarchy before a correct solution can be attained. In reproductive thinking the habit families containing the correct responses are dominant at the outset of the problem, as the result of training and generalization from other situations. Or they rapidly become dominant in the compound hierarchy through the reinforcement of individual response members of the habit family. In productive thinking the habit families containing the correct responses are initially low in the compound hierarchy. They become dominant following the extinction of the dominant habit families which lead to incorrect solutions.

Experiments on the effects of direction in the pendulum problem by Maier (12) and by Weaver and Madden (24) are a special case of productive thinking, in that instructions and demonstrations are employed to increase the reaction potential of the anticipatory goal response and individual response members of the habit families leading to a correct solution. The problem is to construct two pendulums which would make chalk marks on two different places on the floor. In Maier's experiment (12) one group of subjects was given only the statement of the problem. Other groups received the statement of the problem plus various additional instructions or demonstrations. One of these groups was given three different demonstrations of operations on the material which were necessary for solution of the problem. They were shown how to make a plumb line, how to combine poles by using a clamp, and how to wedge poles against a surface. A third group was given these demonstrations and told that they must combine them for a solution of the problem. A fourth group was told that it would be advantageous if the pendulum could hang from the ceiling. They were given a "direction." The fifth group received the demonstrations and the direction. All of the problem solutions except one occurred in this last group.

According to the present formulation the experimenter's statement that it would be advantageous to hang the pendulum from the ceiling tended to elicit an anticipatory response for this goal. A wide variety of equivalent responses instrumental in leading to this goal therefore received an immediate increment in reaction potential. However, for a correct solution to occur, certain specific responses must be elicited. The three demonstrations given the last group increased the tendency of these responses to occur within their respective habit family hierarchies. The increased frequency of solutions under these conditions would follow from the differential increase in reaction potential of the relevant responses and the lawful nature of trial and error learning. However, since a large number of responses belong to a given hierarchy, and the correct responses may still not be dominant, extensive extinction of incorrect responses must occur. If the correct responses are very low in the dominant hierarchy, a solution may not occur at all because of the extensive generalization of the effects of extinction of the incorrect responses. Another basis for failure in this group is that despite the instructions tending to arouse the appropriate anticipatory goal response, some subjects, presumably as the result of self-instructions, induce different anticipatory goal responses. These are the subjects that adopt an inappropriate approach to the problem, according to Maier.

Groups 2 and 3, which are not given the directional instructions but receive the demonstrations, also have an increase in reaction potential for the three response sequences necessary for a solution. However, the anticipatory goal response and the related class of responses necessary to suspend the pendulum from the ceiling are not increased in strength, which is presumably why these subjects failed to solve the problem. However, contrary to Maier, Weaver and Madden (24) found no difference between the performance of groups 3 and 5.

Their experiment implies that the appropriate habit family for suspending the pendulums from the ceiling may be elicited by self-instructions, or that the increase in habit strength of the three necessary response sequences by itself may be sufficient for the solution of the problem in some individuals. . . .

REFERENCES

2. Cofer, C. N. Verbal behavior in relation to reasoning and values. In H. Guetzkow (Ed.), *Groups, leadership and men*. Pittsburgh: Carnegie Press, 1951. Pp. 206–217.
3. Cofer, C. N., & Foley, J. P., Jr. Mediated generalization and the interpretation of verbal behavior: I. Prolegomena. *Psychol. Rev.*, 1942, **49,** 513–540.
4. Cohen, J. The concept of goal gradients: a review of its present status. *J. gen. Psychol.*, 1953, **49,** 303–308.
5. Dollard, J., & Miller, N. E. *Personality and psychotherapy*. New York: McGraw Hill, 1950.
6. Doob, L. W. The behavior of attitudes. *Psychol. Rev.*, 1947, **54,** 135–156.
7. Duncker, K. On problem solving. *Psychol. Monogr.*, 1945, **58,** No. 5 (Whole No. 270).
8. Duncker, K., & Krechevsky, I. On solution-achievement. *Psychol. Rev.*, 1939, **46,** 176–185.
9. Hull, C. L. The concept of the habit-family hierarchy and maze learning. *Psychol. Rev.*, 1934, **41,** 33–54, 134–152.
10. Hull, C. L. *A behavior system*. New Haven: Yale Univer. Press, 1952.
12. Maier, N. R. F. Reasoning in humans: I. On direction. *J. comp. Psychol.*, 1930, **10,** 115–143.
13. Maier, N. R. F. The behavior mechanisms concerned with problem solving. *Psychol. Rev.*, 1940, **47,** 43–58.
14. Maier, N. R. F. Reasoning in humans: III. The mechanism of equivalent stimuli and of reasoning. *J. exp. Psychol.*, 1945, **35,** 349–360.
15. Maltzman, I., & Eisman, E. Two kinds of set in problem solving. Paper read at Amer. Psychol. Ass., New York, September, 1954.
16. Maltzman, I., Fox, J., & Morrisett, L., Jr. Some effects of manifest anxiety on mental set. *J. exp. Psychol.*, 1953, **46,** 50–54.
17. Maltzman, I., & Morrisett, L., Jr. Different strengths of set in the solution of anagrams. *J. exp. Psychol.*, 1952, **44,** 242–246.
18. Maltzman, I., & Morrisett, L., Jr. The effects of single and compound classes of anagrams on set solutions. *J. exp. Psychol.*, 1953, **45,** 345–350.
19. Osgood, C. E. *Method and theory in experimental psychology*. New York: Oxford Univer. Press, 1953.
20. Rees, H., & Israel, H. An investigation of the establishment and operation of mental sets. *Psychol. Monogr.*, 1935, **46,** No. 6 (Whole No. 210).
21. Rigby, W. K. Approach and avoidance gradients and conflict behavior in a predominantly temporal situation. *J. comp. physiol. Psychol.*, 1954, **47,** 83–89.
22. Spence, K. W. The nature of discrimination learning in animals. *Psychol. Rev.*, 1936, **43,** 427–449.
23. Spence, K. W. Theoretical interpretations of learning. In C. P. Stone (Ed.), *Comparative psychology*. New York: Prentice-Hall, 1951. Pp. 239–291.
24. Weaver, H. E., & Madden, E. H. "Direction" in problem solving. *J. Psychol.*, 1949, **27,** 331–345.
25. Wolters, A. W. On conceptual thinking. *Brit. J. Psychol.*, 1933, **24,** 133–143.

24.

Vertical and Horizontal Processes in Problem Solving *[1]

Howard H. Kendler and
Tracy S. Kendler

Methodological Problems in Problem Solving Research

. . . Anybody who does research is—or should be—aware that every decision he makes cannot be justified by facts or logic. Some decisions must be made on the basis of personal intuition. This is particularly true for the researcher in problem solving who must make three strategic decisions which cannot help but have profound influences on his research and the ideas they generate (Kendler, 1961). These decisions, which are not completely independent, are related to the place of problem solving in psychology, the use of complex or simple experimental tasks, and the selection of a pretheoretical model to guide research. Considering the volitional nature of these problems, as well as the current status of psychological knowledge, it would be both inappropriate and erroneous to consider these methodological problems as offering only one sensible alternative. Adopting this point of view would do much to minimize the needless disputation that seems to perennially surround matters of research strategy.

Accepting the principle that a basic research strategy is not simply an outgrowth of logical and factual considerations does not reduce one to making decisions in either a haphazard or random manner. A given strategy can be adopted on the basis of rational considerations as long as it is realized that other reasonable attitudes might lead to the adoption of different decisions.

The history of problem solving in particular and psychology in general suggests that problem solving can best be conceptualized not as a basic psychological process, but instead as one that reflects the interaction of more fundamental processes (e.g., learning, perception, and motivation).

If problem solving is not viewed as a unitary process, how is an appropriate experimental situation selected to investigate it? One possibility is that a problem can be selected from a "true life" situation such as trouble-shooting electronic equipment. Or problems can be invented (Duncker, 1945; Maier, 1930) that capture the flavor, if only partially, of problems we meet in everyday life.

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* From H. H. Kendler and T. S. Kendler, Vertical and horizontal processes in problem solving, *Psychol. Rev.*, **69**, 1–16 (1962). Reprinted by permission of the authors and the American Psychological Association.

[1] An earlier version of this paper was delivered by Howard H. Kendler as an invited address to the 1960 meeting of the Eastern Psychological Association, which was held in New York City. The authors are indebted to the Office of Naval Research and the National Science Foundation for their support of the research reported in this paper.

A more analytical approach can be taken to the selection of an experimental situation to investigate problem solving. If problem solving is compounded of elementary behavioral processes, then it may be more strategic to devise some simple problems in which the relationships of fundamental psychological mechanisms to problem solving are highlighted. That is, tasks should be devised not to duplicate or imitate everyday problems, but instead to isolate and magnify the basic mechanisms that operate in such complex tasks.

This analytical approach which is favored by the authors suffers from one major drawback. How is it possible to know the basic mechanisms of problem solving prior to their discovery? Obviously, excepting divination, there is no method. But this does not prevent the analytical approach from operating. The researcher can prejudge theoretical issues by formulating a model of what he guesses problem solving to be like. The model can guide the investigator in selecting the hypotheses to test, as well as the experimental situations in which to test them.

This brings us to the third and most important decision a problem solving researcher has to make: his choice of a pretheoretical model (Koch, 1959). A pretheoretical model is not equivalent to a theory. The criterion of validity cannot properly be applied to it because essentially a pretheoretical model is an informal conception that operates as an analogy (Lachman, 1960). It is conceivable that different models (e.g., learning, perception, information theory) can all lead to fruitful and valid theories of problem solving.

Psychologists have many possibilities from which to choose their model. These models can be conveniently divided into two main categories: the empirical model that springs primarily from experimental data, and the formal model that is usually generated by mathematical or logical systems. Among the empirical models that have achieved some acceptance are those that are based on introspective findings (e.g., the four successive stage model of "preparation," "incubation," "inspiration," and finally "verification"), the facts of perception, and those of learning. Some formal models used are those dependent upon stochastic models, game theory, and the operation of computers.

The present authors adopted an S-R learning pretheoretical model. The decision no doubt was influenced by professional training and past research efforts. But other considerations entered. For the past 4 decades S-R learning psychologists have probably been the most active experimental and theoretical group in psychology. To some, if not a large, extent this can be attributed to the fruitful and cleansing effect S-R language has upon designing, reporting, and interpreting research. S-R language forces the psychologist to focus his attention on objectively defined environmental and behavior variables and thus encourages the collection of data and the testing of ideas. The efforts of S-R learning psychologists have supplied a host of facts, concepts, and hypotheses that can be exploited in an exploratory excursion into the realm of problem solving.

The facts and theories of learning, however, do not spontaneously coalesce to form a model that can guide research in problem solving. Some selection must be made. S-R learning theory does not represent a single organized formulation. Anyone who is familiar with the systematic orientations of Hull (1952), Guthrie (1952), Spence (1956), and Skinner (1953) is aware of this. Many of these systematic differences, however, become attenuated and some even disappear when viewed from the distance of problem solving behavior. It is possible and perhaps even profitable to develop a learning model for problem solving that ignores many of the points of disagreement among S-R theories.

Much of the objection to S-R language stems from the apparent discrepancy between active, flowing behavior and the inert, static, single S-R association. Using S-R language does not mean that complex behavior *actually* consists of S-R connections. After analyzing the concept of light, Toulmin (1953), concludes: "We do not *find* light atomized into individual rays: we *represent* it as consisting of such rays" (p. 29). Applying the same idea to the concept of the S-R association: "We do not *find* behavior atomized into individual S-R associations: we *represent* it as consisting of such S-R associations." The concept of the S-R association, therefore, must be judged not in terms of its ability to provide a clear image of behavior, but rather in its capacity to represent the facts of behavior.

Pretheoretical Model of Problem Solving

An S-R model needs to represent two important characteristics of problem solving behavior. These characteristics are behavior is continuous, and at any one time behavior consists of several habits. The terms "horizontal" and "vertical" are used to refer to these processes; horizontal to the continuity of behavior against the dimension of time, and vertical to the assumption that independent levels of behavior (i.e., S-R units) occur simultaneously.

The assumption that S-R associations do not occur in isolation, but instead are linked together to form integrated, continuous behavior goes back many years (e.g., Watson, 1913). Today the process is most commonly referred to as chaining. Skinner (1953) and his associates have developed powerful techniques that shape behavior into long, complicated chains. The mass of data they have collected suggests important principles governing habit chaining. There is little doubt that when their quasitheoretical system is exploited fully with autoinstructional devices that important insights into problem solving behavior will emerge, particularly in relation to how an added bit of knowledge can trigger problem solution. The kind of chaining with which the Skinnerians have dealt (i.e., adding new S-R units to an already functioning chain) does not exhaust all the problems associated with the horizontal processes of problem solving. Of particular importance to problem solving is the *spontaneous* integration of separate habits which occurs when an organism infers the consequences of combining previously independent S-R units. This kind of chaining was investigated in Kohler's (1925) classical studies of insight and in the more controlled reasoning experiments of Maier (1930). More recently the authors (Kendler & Kendler, 1956, 1961; Kendler, Kendler, Pliskoff, & D'Amato, 1958) have tried to identify some of the important variables that enable children to combine separate experiences in order to solve an inference-type problem. Much of the research reported in this paper will be concerned with how mediated stimulus and response events aid in the formation of problem solving chains.

The assumption of vertical processes, i.e., the organism responds several different ways at any one time, is also not a novel one. Every psychologist is aware that organisms make several different responses simultaneously, although typically only one is attended to. Sometimes the different responses are interrelated, as is the case between the heart and respiration rates of a fearful organism. In other cases the different responses are independent, e.g., a person's conversation is uninfluenced by his tugging at his ear lobe. The best laboratory example of vertical processes, and one that has much relevance to problem solving, is shown in Figure 1. Those familiar with introductory psychology textbooks will recognize this diagram as representing classical conditioning. Notice that the two solid lines indicate independent S-R units which are operating simultaneously. One is the tone that initiates the "investigatory" response, and the other is the food which elicits salivation. Initially these two associations operate in a *parallel* fashion, but as a result of their simultaneous occurrence an *interaction* takes place which is expressed by the broken line representing the acquired conditioned response.

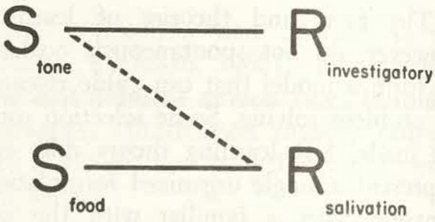

FIG. 1. An S-R representation of classical conditioning. From Kendler and Kendler: Vertical and horizontal processes in problem solving.

Obviously the brief reference to horizontal and vertical processes in which it is assumed fundamental S-R principles operate (e.g., discrimination, generalization, etc.) presents at best the barest skeleton of a model of problem solving. It needs the flesh and skin of experimental facts to give it solidity and theoretical principles to clothe it in scientific respectability. Let us now review some of the progress that has been made in this direction.

Concept Learning and Utilizaton

Although the primitive model just described fails to generate any research by itself, it does suggest that individual experiments cannot be directed at *problem solving in its entirety*. There are too many aspects to this phenomenon. The researcher, in designing an experiment, must scan the entire problem solving process and then focus upon that segment that promises to yield fruitful results and is also amenable to investigation.

For reasons that will become evident, it was decided to compare reversal and nonreversal shifts in a simple concept learning task. Figure 2 characterizes each kind of shift by showing a *simplified* version of an experimental situation used with children. The stimuli (cups) for their first discrimination differed simultaneously on two dimensions (size and brightness). The subject is rewarded for responses to one dimension (e.g., large cup is positive, small cup is negative). The other dimension is irrelevant. After learning the first discrimination, the subject is forced to shift to another response. In a reversal shift the subject is required to respond to the same dimension on which he was originally trained, but his overt choice has to be reversed, e.g., he has to shift from a *large* cup to a *small* one. For a nonreversal shift the previously irrelevant dimension becomes relevant, e.g., black becomes positive after large had been positive.

Buss (1953) reported that college students executed a reversal shift more rapidly than a nonreversal shift. He attributed this superiority to the intermittent reinforcements that retard the progress of a nonreversal shift. For example, in Figure 2,[2] when a subject is making a nonreversal shift from large positive to black positive, he is reinforced when choosing the large black cup in preference to the small white cup. This fortuitous reinforcement of the choice of the large cup helps maintain the size discrimination and hence retards the learning of the brightness discrimination. The reversal shift group, on the other hand, receives no reinforcement of the previously correct responses, since they are 100% *non*reinforced.

This analysis is at best incomplete. The work of Kendler and Vineberg (1954) suggested that adult human concept learning cannot be represented adequately by a single-unit S-R theory in which the external stimulus is directly connected to the overt response. Instead, a mediational mechanism (see Figure 3) is required which assumes that the external stimulus evokes an implicit response which produces an implicit cue that is connected to the overt response.

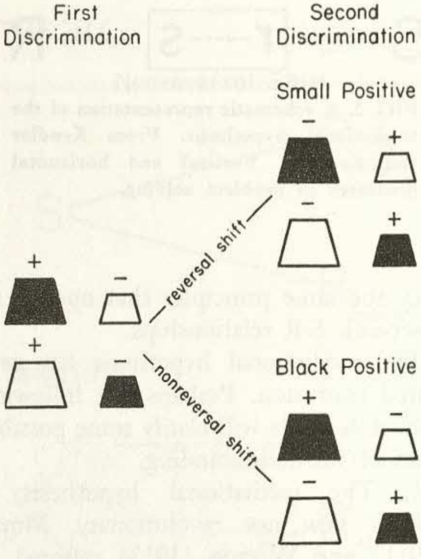

FIG. 2. Examples of a reversal and a nonreversal shift. From Kendler and Kendler: Vertical and horizontal processes in problem solving.

It would be useful to digress for a moment to comment about the epistemological status of these inferred stimulus and response events which are enclosed in the rectangle to emphasize their hypothetical character. Although not directly observable, they are "tied to" environmental and behavioral events. The basic assumption of the mediational hypothesis, at least for the time being, is that the implicit stimulus and response events

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[2] The purpose of Figure 2 is to clarify the meaning of both a reversal and nonreversal shift. It would be misleading to believe that it represents *exactly* the methodology of "reversal-nonreversal" studies reported in this paper. For all experiments reported, except that of Buss (1953), designs were used that controlled for fortuitous intermittent reinforcements effects in a nonreversal shift.

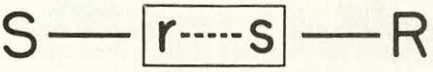

FIG. 3. A schematic representation of the mediational hypothesis. From Kendler and Kendler: Vertical and horizontal processes in problem solving.

obey the same principles that operate in observable S-R relationships.

The mediational hypothesis has generated confusion. Perhaps the following brief statements will clarify some possible areas of misunderstanding.

1. The mediational hypothesis is neither new nor revolutionary. Meyer (1911) and Watson (1913) referred to it, and Hull (1930) gave it a more formal status by coining the concept of the "pure stimulus act." Guthrie (1952) has always laid heavy stress on a mediational-type hypothesis when emphasizing the importance of proprioceptive stimulation in learning.

2. The implicit stimulus and response events *need not* be conceived as having an existence independent of their relation to independent and dependent varibles. These implicit events are theoretical constructs. Their epistemological status is closer to such concepts as drive and habit than to directly observable stimulus and response events.

Some mediating events can conceivably and probably will be coordinated to introspective reports, language behavior, muscular movements, and other observable events. Coordinations of this sort can be useful in developing mediational theory. But such coordinations are not *essential* to mediational theory. The fact that genes are not directly observable (at least according to the geneticists consulted) does not interfere with their theoretical and practical usefulness. Even if it were possible to observe a gene directly, it would be necessary to distinguish between it as an observable entity and as a concept within a nomological network. It would be unwise, and strategically shortsighted, to *identify* mediational events with introspective reports or language behavior, or other observable events. The "valadity" of the mediational mechanism does not depend on being coordinated with observable events, but depends instead on being utilized in a successful explanatory system.

Figure 4 characterizes reversal and nonreversal shifts in terms of both a single unit S-R analysis and a mediational one.[3] It would be predicted, according to a

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[3] Figure 4 highlights the problem of what are the effective stimuli that are associated to the overt response in both a reversal and nonreversal shift. It is not intended to be a detailed analysis of which there may be several alternatives. For example, in a single unit theory the habit to choose the large container might result from learning two separate specific habits (e.g., the choice of a large black container when coupled with a small white one and the selection of a large white container when paired with a small black one). Another possibility, which would be consistent with Spence's theory (1936), is that the response is to the effective stimulus *large* since responses to the other features of the environment are not consistently reinforced. Similarly adult subjects in a reversal shift might use the mediator *size* or *large* or both. The effective stimulus which is controlling the organism's response must be determined by experimentation. The point made here is that the general implications of the single unit and mediational theories, as discussed in this paper, would be the same for a number of different effective stimuli.

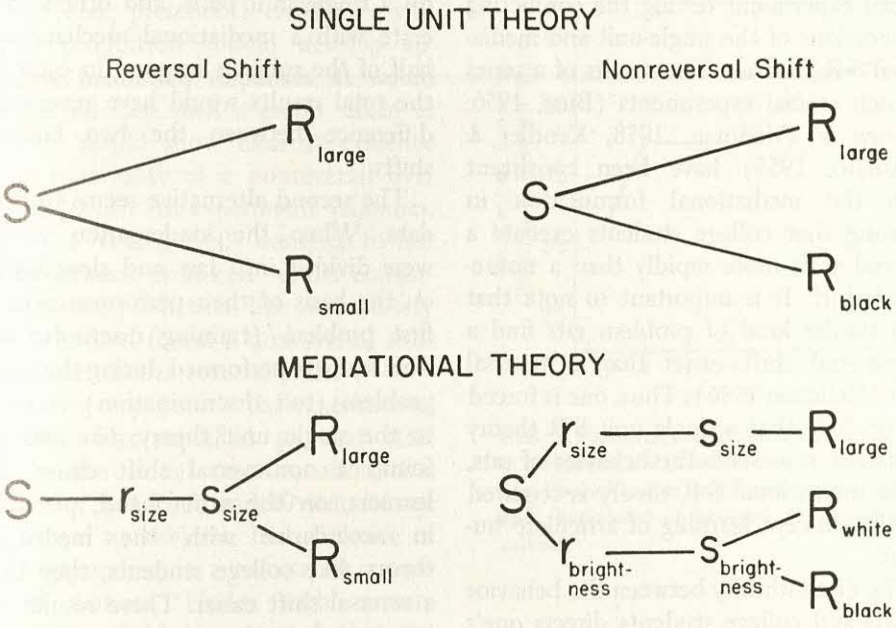

FIG. 4. A single unit and mediational S-R analysis of a reversal and nonreversal shift. From Kendler and Kendler: Vertical and horizontal processes in problem solving.

single unit hypothesis, that if fortuitous intermittent reinforcements were eliminated from a nonreversal shift, it would occur more rapidly than reversal shift. The reason for this is that at the time of the shift the difference between the strength of the dominant incorrect habit and the to-be-correct habit is much greater for the reversal, as compared to the nonreversal shift. Consequently more training will be required to make the correct habit dominant in a reversal shift. According to the mediational theory the situation is entirely different. A reversal shift enables the subject to utilize the same mediated response. Only the overt response has to be changed. A nonreversal shift, on the other hand, required the acquisition of a *new* mediated response, the cues of which have to be attached to a *new* overt response. Because the old mediational sequence has to be discarded and a new one formed, the nonreversal shift should be executed more slowly than a reversal shift.[4] Thus, if it were possible to eliminate fortuitous intermittent reinforcements, then the stage would be set for a crucial experiment testing the conflicting implications of the single-unit and mediational S-R theories. The results of a series of such crucial experiments (Buss, 1956; Harrow & Friedman, 1958; Kendler & D'Amato, 1955) have been consistent with the mediational formulation in showing that college students execute a reversal shift more rapidly than a nonreversal shift. It is important to note that in a similar kind of problem rats find a nonreversal shift easier than a reversal shift (Kelleher, 1956). Thus, one is forced to conclude that a single unit S-R theory accurately represents the behavior of rats, while mediational S-R theory is required for the concept learning of articulate humans.

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[4] There are two possible ways of analyzing the superiority of a reversal shift over a nonreversal shift within an S–R mediational framework. One is to simply count the number of new associations that have to be formed. As Figure 4 indicates only one new association has to be formed in a reversal shift while two have to be formed for a nonreversal shift. Another possibility is that a mediating response is more difficult to extinguish than is an overt response. For the present the formulation can remain open-ended until information relevant to these two alternatives is gathered.

The discontinuity between the behavior of rats and college students directs one's attention toward the conditions responsible for the development of mediational processes. Somewhere on a hypothetical evolutionary dimension between the rat and college student there should be a point where a transition is made from a single unit to mediational control. An obvious place to locate this point would be in the behavior of young children.

A study with kindergarten children (Kendler & Kendler, 1959) showed that these children as a group executed a reversal and nonreversal shift at approximately the same rate. One might conclude that the point in human development was discovered which was psychologically halfway between the white rat and the college student, since the kindergarten children were neither responding in a single unit nor mediational manner, but instead in some compromise fashion. Another possibility is that the children had reached a transitional stage in development, in which the task to which they were subjected led some to function on a single unit basis, and others to operate with a mediational mechanism. If half of the subjects respond in each way, the total results would have revealed no difference between the two kinds of shifts.

The second alternative seems to fit the data. When the kindergarten children were divided into fast and slow learners on the basis of their performance in the first problem (training discrimination), slow learners performed during the second problem (test discrimination) according to the single unit theory; like rats they found a nonreversal shift easier. Fast learners, on the other hand, performed in accordance with the mediational theory; like college students, they found a reversal shift easier. These results were interpreted as demonstrating that these kindergartners, taken as a group, were in the process of developing mediating responses relevant to this task, and that some were further along than others.

TABLE 1

Mean Number of Trials to Criterion on Test Discrimination for Subjects Scoring above and below the Median on the Training Discrimination

Group	PERFORMANCE ON TRAINING DISCRIMINATION	
	Above median (slow learners)	Below median (fast learners)
Reversal	24.4	6.0
Nonreversal	9.0	15.5

From Kendler and Kendler: Vertical and horizontal processes in problem solving.

If this interpretation be correct, then it would follow that for a group of younger (i.e., preschool) children a still smaller proportion should develop appropriate mediating responses. It would be expected that such a group, taken as a whole, would show clearcut evidence of the superiority of a nonreversal over a reversal shift. An experiment (Kendler, Kendler, & Wells, 1960) designed to test this hypothesis produced results consistent with this prediction; like rats, nursery school children found a nonreversal shift to be easier than a reversal shift.

In a very recent study the experimental procedure was modified so that after learning the initial discrimination, the children of 3, 4, 6, 8, and 10 years of age who served as subjects, had a choice of either responding in a reversal or a nonreversal manner. Under such circumstances, it would be expected that the proportion of children who respond in a reversal manner would increase with age. Figure 5 shows that the percentage of children whose chose a reversal shift rose gradually from 37.5 at 3 to 62.5 at 10.

Generalizing from all of these results, it would seem that in their early development, children tend to respond in a manner consistent with a single unit S-R theory. With age, they develop a tendency to respond in a mediational manner. The last study cited suggests that it is, or will soon be, possible to ascertain the lawful relationship governing the course of this development.

The point of these experiments is not to classify children into one of two categories: rat-like or human-like. Their aim is to lay the groundwork for experiments designed to investigate the mediational process itself. If one wants to investigate mediational processes, does it not seem sensible to scrutinize them at the time when they are developing? Answering this question in the affirmative, it was decided to investigate the relationship between the hypothesized mediational processes and verbal behavior—a relationship everybody assumes to be intimate and important.

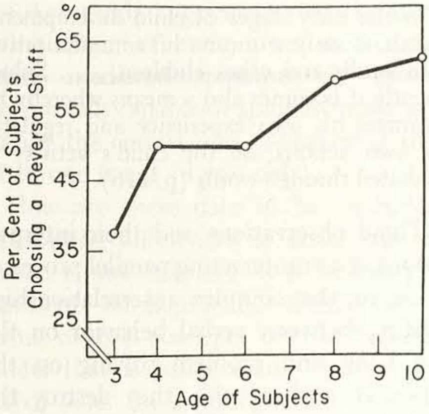

FIG. 5. Percentage of children responding in a reversal shift manner as a function of age. From Kendler and Kendler: Vertical and horizontal processes in problem solving.

Particularly relevant to this attempt to coordinate verbalization with mediation were observations that during the course of the experiments just described, it was not uncommon for children to verbalize spontaneously the correct solution while simultaneously making an incorrect choice. A few children did this for many consecutive trials. This observation is relevant to the concept of vertical processes. Two chains of habits are occurring simultaneously. One has to do with verbal response; the other with the overt choice. For these children the two chains are parallel, that is, they do not interact.

Luria (1957), the Russian psychologist, made somewhat similar observations in his research with children. He explains this sort of phenomenon in the following way:

> In the early stages of child development, speech is only a means of communication with adults and other children. . . . Subsequently it becomes also a means whereby he organizes his own experience and regulates his own actions. So the child's activity is mediated through words (p. 116).

These observations and their interpretations of noninteracting parallel processes point to the complex interrelationships existing between verbal behavior on the one hand and problem solving on the other. If nothing else, they destroy the illusion that it is reasonable to describe an organism as verbal or nonverbal without considering the problem with which it is confronted. The terms verbal and nonverbal become meaningful—and fruitful—when related to specific problem solving tasks.

It would seem fruitful to investigate the cue function of words for children of two age levels. One possibility is that age influences problem solving only in so far as it leads to the acquisition of words. If younger children, say 4 years of age, could acquire the same words as 7-year-olds, they would solve a simple concept-learning problem the same way. The other possibility is that the acquisition of the verbal label by itself is not sufficient; the word must be integrated with other behavioral chains to influence problem solving behavior. And for this to happen some developmental changes must first take place.

In order to test these two alternatives, children of 4 and 7 years of age were presented with another variation of the reversal shift problem as shown in Figure 6. They initially learned a simple discrimination between a pair of stimuli that varied simultaneously in size and brightness. In the illustration provided in Figure 6, the large black square is correct. While they were learning, the children were required to verbalize aloud the stimuli to which they were responding. One-third learned to say "large" (or "small" as the case may be) by the simple device of instructing them to tell the experimenter which was correct, the large or the small one. Another third learned to say "black" (or "white") in a corresponding way. The remaining third was not required to say anything. After learning the discrimination, all subjects were presented with a reversal shift. In the example depicted in Figure 6, the shift is to small regardless of size. Thus, the group that initially described the correct stimulus as "large" had verbalized the relevant dimension. The verbal response of "black" was irrelevant to this reversal shift.

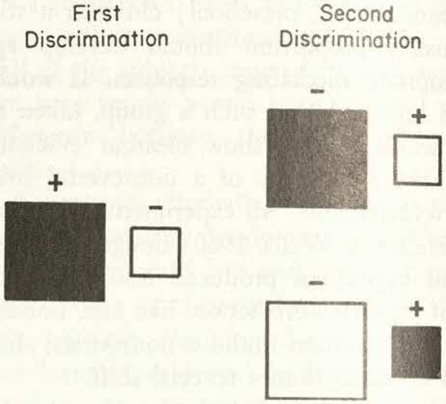

FIG. 6. The experimental procedure used to study the influence of verbal habits on a reversal shift. From Kendler and Kendler: Vertical and horizontal processes in problem solving.

Figure 7 shows the results of the three experimental groups for the two age levels. If developmental processes affect the utilization of verbal responses in problem solving, then it would be expected that the three verbalization conditions (which produced a significant main ef-

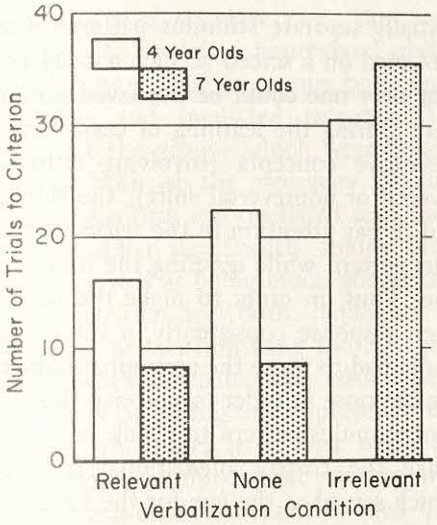

FIG. 7. The effect of verbalizations on a reversal shift for 4- and 7-year-old children. From Kendler and Kendler: Vertical and horizontal processes in problem solving.

fect) would influence the behavior of the two age groups differently. These results suggest, but not quite at a significant level, that there is an interaction effect: Figure 7 shows that the younger children profited by making the kind of verbal response appropriate to a reversal shift, while they were hindered by learning inappropriate verbal responses. With no verbalization the 7-year-old children who presumably were responding largely in a mediational manner, accomplished a reversal shift much more rapidly than their younger counterparts. But unlike the 4-year-olds, they did not profit from being trained to make the relevant responses. At 7 years of age they are capable of making the response themselves and outside help appears to be of little use. In contrast, the influence of irrelevant verbalizations is marked. The performance of the 7-year-olds was even poorer than that of the 4-year-olds, suggesting that the interfering effects of being given an inappropriate mediated response are greater when one is capable of spontaneously generating the correct one (7-year-olds) than when one is not (4-year-olds).

How are these data to be explained? Attributing differences to developmental factors is not sufficient. It is necessary to represent developmental differences in terms of the concepts of the behavior model that is being used. That is, if a verbal label for a young child does not possess the same cue function as it does for an older child, then it becomes necessary to specify how and why this comes about. To some extent this has been done by emphasizing the transition from a single unit to a mediational system, as well as suggesting that with age an increase occurs in interaction among chains of different vertical levels. But obviously this analysis of the developmental process demands further theoretical and empirical development.

These studies are intimately related to the oft-reported finding that many species of subhuman animals are able to make a fairly rapid reversal shift *if* they receive a previous series of such shifts. Rats (Buytendijk, 1930; Krechevsky, 1932) show a marked improvement in executing successive reversals. They finally reach a point (Dufort, Guttman, & Kimble, 1954), in a T maze, where they learn to go to a new rewarded goal after making only one error. Even more dramatic are the rapid discrimination reversals exhibited by Harlow's (1949) monkeys. But fish (Wodinsky & Bitterman, 1957) exhibit only a slight improvement in successive reversals, while isopods (invertebrates) show no improvement (Thompson, 1957).

Because of the necessity to use somewhat different experimental procedures for different species, it is difficult to draw an unqualified conclusion about the ability of different species to transfer what has been learned from previous reversal shifts to a new one. But the suggestion is strong that as you ascend the evolutionary scale organisms acquire a greater capacity to generate cues that enable them to make rapid reversal shifts. This behavior, according to our analysis, borders on the language responses of humans. The main difference is that our human subjects, except those of a very young age, exhibit rapid reversals without any previous reversal training. Whereas the human automatically seems to generate a mediated response that provides the basis for his rapid reversal, the animal subject must gradually acquire an ability to respond appropriately to some response produced cue resulting from nonreinforcement of a previously correct response.

Up to now, the reversal and nonreversal technique has been used to investigate mediational and developmental variables. It has proved sufficiently flexible to be used in a study (Kendler, Glucksberg, & Keston, 1961) which was designed to lengthen a problem solving chain so that the interaction between various segments could be observed. In this study a perceptual orienting S-R unit was added on to the mediational chain already described. Figure 8 illustrates in an oversimplified manner the behavioral sequence involved in this study in which subjects had to learn to press the correct button when two physically discrete and spatially separate stimulus patterns were projected on a screen at such a rapid rate that only one could be perceived on any trial. During the learning of each of two successive concepts (involving either a reversal or nonreversal shift), the subject had to pay attention to the relevant stimulus pattern while ignoring the irrelevant one. Thus, in order to make the correct overt response consistently, a subject initially had to make the appropriate orienting response in order to perceive the relevant stimulus pattern to which he had to make the correct mediational response which served as the cue for the key-pressing act.

An experimental design was used in which, at the time of the shift from the first to the second concept, one group had already learned the appropriate orienting response as well as the appropriate mediating act. They needed only to learn a new terminal key-pressing response. The shift, for them, was easy to make. In contrast, the behavior of three other experimental groups was significantly worse. One group had to learn a new orienting response, e.g., look to the left instead of the right. Another group had to learn a

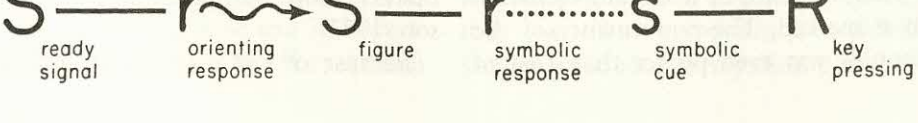

FIG. 8. The hypothesized behavioral chain operating at the time the subject was being shifted to the second concept. (Capital letters refer to directly observable stimulus and response events, while small letters refer to those that are inferred.) From Kendler and Kendler: Vertical and horizontal processes in problem solving.

new mediated response (i.e., they were required to make a nonreversal shift). The last group had to acquire both a new orienting and mediated response. The fact that the groups which were missing one or both of the necessary behavior units (orienting and mediated responses) did not differ significantly among themselves, as well as being much poorer than the group that had both, highlights the problems of synchronizing the S-R units in a behavioral chain. The advantage in this study of having one appropriate unit without the other is at best negligible. The reason for this is that reinforcement is only achieved consistently when both the appropriate orienting and mediating responses are operating. This particular study points to the need for discovering laws associated with the strengthening and weakening of independent S-R units in a problem solving chain, as well as the principles governing their synchronization.

This study also highlighted a very basic problem in all of these reversal studies. This problem has to do with the very first correct response following the reversal shift. After discovering that the previous mode of responding is erroneous, what makes the subject change his response, i.e., push the button that was previously wrong? Introspective reports fail to provide any clearcut answer and even if they did they would be in need of explaining (Kendler, 1961).

One hypothesis is that the selection of the new correct response is due to the operation of a behavioral chain in addition to the one described in Figure 8. The first nonreinforcement in a reversal shift sets off a chain, the consequence of which is to select the response other than the one that was previously correct. This may result from a number of different reasons (e.g., logical considerations, forgetting, etc.). The important point, however, is that the new key-sorting response occurs contiguously with the implicit mediational response appropriate to a reversal shift. As a result, a new association is formed between the old implicit cue and the new key-pressing response.

In essence, what is being stated is that adult subjects, when making or deciding to make the first correct post-shift response, do not adopt the *principle* underlying a reversal shift. Instead, it is assumed processes are operating which encourage the selection of the correct response while an implicit cue appropriate to a reversal shift is operating. This sort of an analysis was described previously (Kendler & Mayzner, 1956) as

> sort of a James-Lange theory of problem solving . . . one makes the overt correct . . . response and if the appropriate symbolic cue is present, then problem solution will occur (pp. 247–248).

Guthrie (1959) says the same thing more neatly: "*What is being noticed becomes a signal for what is being done*" (p. 186).

Again the authors would like to guard against giving the impression of oversimplifying a terribly complex problem. They do not believe the contiguous occurrence of an implicit cue from one chain with the correct overt response from another tells the whole story. This new association in order to persist must be reinforced and in some manner "fit into" the subject's ongoing behavioral chains.

The emphasis on this vertical connection between a cue and a response from different chains is related in a distant way to Hebb's (1958) stressing the role of "chance" in problem solving:

> There are few scientists who have not had the experience of setting out to solve prob-

> lem A and ending up instead with the solution to B. . . . This is serendipity, the art of finding one thing while looking for another (p. 215).

According to the present analysis, serendipity results from the adventitious and contiguous occurrence of a cue and a response which are themselves segments from different behavior chains. Theoretically it should be possible to demonstrate this point experimentally by training subjects to respond simultaneously to two separate tasks. A problem then would have to be presented that requires for its solution the combination of a stimulus from one chain with the response from the other. In such an experimental situation, controlling the time relationship between the two should have an important effect on problem solving. Presumably contiguity between the two should provide the most optimal conditions for problem solving (Underwood, 1952). The development of this kind of experimental procedure should allow for parametric studies of the basic variables of the phenomenon which has commonly been called "insight," as well as throw light upon issues raised by others (e.g., Cofer, 1957; Maltzman, 1955; Saugstad, 1957).

The pretheoretical model that guides the present research has many more facets that can be exploited. Only one will now be mentioned. Glucksberg (1962), for example, extended neobehavioristic drive theory (Spence, 1956) to problem solving. He used a functional-fixedness problem (Adamson, 1952; Duncker, 1945) in which the correct response in the habit hierarchy could either be made to be low or high. If the correct habit was low, it would be expected that a strong drive would retard problem solving because it would retard the extinction of the dominant incorrect response (Kendler & Lachman, 1958; Perin, 1942). Since drive energizes behavior, a high drive should facilitate problem solving performance when the correct habit is dominant. The findings were consistent with this analysis.

Because functional-fixedness problems are often represented in perceptual terms, Glucksberg was interested in seeing whether the same drive model could be applied to a simple perceptual recognition problem in which subjects were instructed to identify tachistoscopically presented words as rapidly as possible. The results were similar to those reported for the functional-fixedness study: when the correct response was dominant, an increase in drive improved performance, i.e., the visual duration threshold was lowered. In contrast, increasing drive when the correct response was low in the hierarchy raised the threshold.

There is obviously still much more work, both empirical and theoretical, needed to develop the model that has been described. At this point it may be appropriate to summarize the major points of this paper.

There is not just one way to investigate problem solving. The researcher who is interested in problem solving has several different pretheoretical models from which to choose. This paper reported the results of a research program based on an S-R model in which the importance of horizontal and vertical processes were emphasized. Horizontal processes refer to the linking of successive S-R units into a behavioral chain, while vertical processes refer to the assumption that independent chains occur simultaneously. A series of experiments was reported, the implications of which supported postulating a mediational mechanism within a behavioral chain. By comparing the behavior of human subjects of different ages, as well as relating their results to lower animals, it was possible to infer that as a child matures he makes a transition from responding on the basis of a single unit S-R mechanism to a mediational one. Additional data were cited that suggest the full impact of verbal behavior on problem solving depends on developmental processes that encourage interaction between chains at different vertical levels. It was also suggested that problem solving begins in a simple concept learning task when a correct overt response from one behavioral chain occurs contiguously and adventitiously with the appropriate implicit cue from another chain. The paper was concluded by citing findings that suggested the neobehavioristic drive theory which assumes that the effect of different levels of drive depends on the position of the correct response in the habit hierarchy is applicable to a functional-fixedness problem as well as a perceptual-recognition task.

If nothing else, it is hoped that the present paper demonstrates that it is possible to investigate problem solving in a systematic fashion. If more psychologists accepted this possibility and were willing to expend their research energies in the field of problem solving, progress in this area would be greater than it is today.

REFERENCES

Adamson, R. E. Functional-fixedness as related to problem solving. *J. exp. Psychol.*, 1952, **44,** 288–291.

Buss, A. H. Rigidity as a function of reversal and nonreversal shifts in the learning of successive discrimination. *J. exp. Psychol.*, 1953, **45,** 75–81.

Buss, A. H. Reversal and nonreversal shifts in concept formation with partial reinforcement eliminated. *J. exp. Psychol.*, 1956, **52,** 162–166.

Buytendijk, F. J. J. Über das Umlernen. *Arch. Néerl. Physiol.*, 1930, **15,** 283–310.

Cofer, C. N. Reasoning as an associative process: III. The role of verbal responses in problem solving. *J. gen. Psychol.*, 1957, **57,** 55–58.

Dufort, R. H., Guttman, N., & Kimble, G. A. One trial discrimination reversal in the white rat. *J. comp. physiol. Psychol.*, 1954, **47,** 248–249.

Duncker, K. On problem solving. *Psychol. Monog.*, 1945, **58** (5, Whole No. 270).

Glucksberg, S. The influence of strength of drive on functional fixedness and perceptual recognition. *J. exp. Psychol.*, 1962, in press.

Guthrie, E. R. *The psychology of learning.* (Rev. ed.) New York: Harper, 1952.

Guthrie, E. R. Association by contiguity. In S. Koch (Ed.), *Psychology: A study of a science.* Vol. 2. New York: McGraw-Hill, 1959. Pp. 158–195.

Harlow, H. F. The formation of learning sets. *Psychol. Rev.*, 1949, **56,** 51–65.

Harrow, M., & Friedman, G. B. Comparing reversal and nonreversal shifts in concept formation with partial reinforcement controlled. *J. exp. Psychol.*, 1958, **55,** 592–597.

Hebb, D. O. *A textbook of psychology.* Philadelphia: Saunders, 1958.

Hull, C. L. Knowledge and purpose as habit mechanisms. *Psychol. Rev.*, 1930, **37,** 511–525.

Kelleher, R. T. Discrimination learning as a function of reversal and nonreversal shifts. *J. exp. Psychol.*, 1956, **51,** 379–384.

Kendler, H. H. Problems in problem solving research. In, *Current trends in psychological theory: A bicentennial program.* Pittsburgh: Univer. Pittsburgh Press, 1961.

Kendler, H. H., & D'Amato, M. F. A comparison of reversal shifts and nonreversal shifts in human concept formation behavior. *J. exp. Psychol.*, 1955, **49,** 165–174.

Kendler, H. H., Gluckesberg, S., & Keston, R. Perception and mediation in concept learning. *J. exp. Psychol.*, 1961, **61,** 186–191.

Kendler, H. H., & Kendler, T. S. Inferential behavior in preschool children. *J. exp. Psychol.*, 1956, **51,** 311–314.

Kendler, H. H., Kendler, T. S., Pliskoff, S. S., & D'Amato, M. F. Inferential behavior in children: I. The influence of reinforcement and incentive motivation. *J. exp. Psychol.*, 1958, **55,** 207–212.

Kendler, H. H., & Lachman, R. Habit reversal as a function of schedule of reinforcement and drive strength. *J. exp. Psychol.*, 1958, **55,** 584–591.

Kendler, H. H., & Mayzner, M. S., Jr. Reversal and nonreversal shifts in card sorting tests with two or four sorting categories. *J. exp. Psychol.*, 1956, **51,** 244–248.

Kendler, H. H., & Vineberg, R. The acquisition of compound concepts as a function of previous training. *J. exp. Psychol.*, 1954, **48,** 252–258.

Kendler, T. S., & Kendler, H. H. Reversal and nonreversal shifts in kindergarten children. *J. exp. Psychol.*, 1959, **58,** 56–60.

Kendler, T. S., & Kendler, H. H. Inferential behavior in children: II. The influence of order of presentation. *J. exp. Psychol.*, 1961, **61,** 442–448.

Kendler, T. S., Kendler, H. H., & Wells, D. Reversal and nonreversal shifts in nursery school children. *J. comp. physiol. Psychol.*, 1960, **53,** 83–88.

Kohler, W. *The mentality of apes.* New York: Harcourt, Brace, 1925.

Krechevsky, I. Antagonistic visual discrimination habits in the white rat. *J. comp. Psychol.*, 1932, **14,** 263–277.

Luria, A. R. The role of language in the formation of temporary connections. In B. Simon (Ed.), *Psychology in the Soviet Union.* Stanford: Stanford Univer. Press, 1957. Pp. 115–129.

Maier, N. R. F. Reasoning in humans: I. On direction. *J. comp. Psychol.*, 1930, **10,** 115–143.

Maltzman, I. Thinking: From a behavioristic point of view. *Psychol. Rev.*, 1955, **62,** 275–286.

Meyer, M. F. *The fundamental laws of human behavior.* Boston: Gorham, 1911.

Perin, C. T. Behavior potentiality as a joint function of the amount of training and the degree of hunger at the time of extinction. *J. exp. Psychol.*, 1942, **30,** 93–113.

Saugstad, P. An analysis of Maier's pendulum problem. *J. exp. Psychol.*, 1957, **54,** 168–179.

Skinner, B. F. *Science and human behavior.* New York: Macmillan, 1953.

Spence, K. W. The nature of discrimination learning in animals. *Psychol. Rev.*, 1936, **43,** 427–449.

Spence, K. W. *Behavior theory and conditioning.* New Haven: Yale Univer. Press, 1956.

Thompson, R. Successive reversal of a position habit in an invertebrate. *Science,* 1957, **126,** 163–164.

Underwood, B. J. An orientation for research on thinking. *Psychol. Rev.*, 1952, **59,** 209–220.

Watson, J. B. Psychology as the behaviorist sees it. *Psychol. Rev.*, 1913, **20,** 158–177.

Wodinsky, J., & Bitterman, M. E. Discrimination-reversal in the fish. *Amer. J. Psychol.*, 1957, **70,** 569–575.

25.

On the Training of Originality*[1]

Irving Maltzman

There has been a growing research interest in originality during the last decade. Areas of major concern have been the study of the productivity of creative individuals (Dennis, 1958; Lehman, 1953; Taylor, 1956, 1958; Van Zelst & Kerr, 1951), their personality (Barron, 1955; Drevdahl, 1956; Taylor, 1956, 1958), the sociological and cultural factors promoting creativity (Barnett, 1953; Stein, 1953; Taylor, 1956, 1958), and investigations designed to develop reliable paper and pencil tests for the study of individual differences (Guilford, 1950; Springbett, Dark, & Clarke, 1957; Wilson, Guilford, & Christensen, 1953).[2]

Although there is general recognition of the importance of the problem of devising training techniques for facilitating creativity, most of the work in this important area has been anecdotal or merely hortatory (Ghiselin, 1955; Mearns, 1958; Osborn, 1957; Slosson & Downey, 1922).

Scope of This Paper

The purpose of this paper is to review the experimental research that may be relevant to the problem of devising techniques for increasing originality and to indicate the behavioral principles possibly involved in the production of the desired effect.

For purposes of further discussion we shall distinguish between originality and creativity. Originality, or original thinking, as we shall use the term, refers to behavior which occurs relatively infrequently, is uncommon under given conditions, and is relevant to those conditions. Criteria of relevance and uncommonness, of course, must be established for any given situation. This is a problem more readily solvable within the laboratory than without. Creativity, according to the present usage, refers to products of such behavior and the reactions of other members of a society to those products. An invention is a creative product that may have an important effect upon society and is a consequence of original behavior. But considerably more variables enter into the determination of creative works than originality alone. Our distinction implies that an individual may be highly original but not creative. His brilliant theories are never published, or they are not implemented by the necessary research. Perhaps the original research is conducted, but the results are not published or patented. All this may be done, but the work may be overlooked or the implications disregarded by the appropriate community of scholars or society at large. Further common illustrations may be given, indicating that a great many more behavioral and societal variables influence creativity than originality, making the study of originality under simplified laboratory conditions more feasible than that of creativity. Many of these variables may affect original behavior as well, but they are not of such overwhelming importance when the training of originality is considered. Our subsequent discussion therefore will be concerned solely with originality as here defined. One further distinction in the experimental study of original behavior needs to be made. Such behavior is always relative, either to a given individual's past behavior or to the norms of a population of which he is a member (Barron, 1955). The two are no doubt correlated. But it is the latter which is related to creative works; and since all of the pertinent experimental research has been of this kind, we shall be concerned only with the study of originality relative to some group norm.

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[2] These are only selected references and are not intended as an exhaustive survey of the relevant literature. A more complete list of references on originality may be found in Taylor (1956, 1958).

Guilford (1959) also distinguishes between originality and creativity. However, the basis for the distinction stems from his factor analytic approach. Originality, defined essentially in the same fashion as in the present paper, is one of several behavioral traits contributing to creativity. The latter is a more general behavioral trait including as components several forms of flexibility, fluency, and motivational and temperamental traits in addition to originality. Although this is a reasonable empirical classification of traits based upon factor analysis, it does not necessarily contradict the present one. We do not, however, accept Guilford's additional assertion that an S-R approach cannot deal adequately with creativity.

Earlier Accounts of Originality Training

Although psychologists have done relatively little experimental research on the training of originality, nonpsychologists have been concerned with the problem for some time. What is more, their suggestions, although not supported by evidence meeting the usual scientific standards, are frequently in accord with commonly accepted behavioral principles.

For example, Mearns (1958) in a book originally published in 1929 repeatedly emphasizes that in order to facilitate the originality of school children in the arts the teacher must reinforce, manifestly approve, his original efforts. He illustrates many techniques for inducing the child to make public his efforts, to gain the confidence of children so that communication will occur with their "secret unexpressed selves." Furthermore, the teacher is advised to approve of only the genuinely original effort. The teacher is further cautioned to wait patiently for the appearance of original behavior which is fostered by a "permissive atmosphere," the absence of "drill" and excessive discipline. According to Mearns, original behavior appears eventually because all normal children have an urge, energy, or impulse to be creative.

Aside from the romantic approach to a

problem of behavior, we would agree that the way to foster originality is to reinforce such behavior when it occurs. A basic difficulty is that it may not occur at all or at such infrequent intervals that the reinforcements cannot shape up such behavior. Thus the fundamental problem in the training of originality is to devise methods for increasing its occurrence in diverse situations, is to get it to occur in the first place, thereby permitting the operation of reinforcement. If the operant level of originality is too low, conditioning will not be effective, training cannot occur. We are assuming, then, that originality can be learned and that the same principles of conditioning hold as in other forms of operant behavior. Once it occurs it can be reinforced, approved, recognized. It will then show an increased probability of occurrence. An apparent difficulty, however, is that originality is manifestly different from other behaviors. How can the reinforcement of one bit of uncommon behavior increase the frequency of other uncommon behaviors which by definition are different. Despite the apparent paradox, this sort of nonspecific transfer does occur, as we shall see.

Royce (1898), as far as we know, was the first to experimentally attack the problem of devising techniques for facilitating the occurrence of originality. He employed two different procedures. First, Ss were asked to draw a series of nonsense figures unlike anything they had ever seen. A second procedure was to present a series of drawings to S with instructions to draw figures as different as possible from each of the models. Examination of the qualitative changes that occurred under these conditions led Royce to conclude that these procedures may facilitate originality and that they correspond to conditions in society that are conducive to originality.

Slosson and Downey (1922) suggest another method for training and testing originality in writing fiction. They suggest writing a plot, characters, or an entire story, based upon the more unusual messages found in the personal columns of newspapers. Headlines are also proposed as training materials. Variations are possible in the use of the materials by placing restrictions on the kind of plot or characters to be invented. Thus, given an unusual message, the writer is forced to practice literary invention. The assumption is that this form of "mental gymnastics" will increase the originality of his writing.

A simple test of originality suggested by Slosson and Downey (1922) is to determine how many different plots can be written to the same message, and for how many messages can plots be written in a given time interval. A more formalized test is also presented, but no empirical data are given from its use. Likewise, no data are presented on the effectiveness of the training method which appears to have been employed as a teaching technique in creative writing courses at the college level.

Osborn (1957) also believes that originality can be trained and that practice in producing original "ideas" will further develop originality. He gives many exercises designed to provide such training. They typically consist of various kinds of problem situations for which as many different solutions as possible are to be offered. The quantity of different "ideas" is stressed, since it is believed that the likelihood of original "ideas" increases with increases in quantity.

Osborn (1957) has also initiated a procedure of "group ideation" known as "brainstorming" which is designed to evoke original "ideas," and which has received considerable attention from the public press. It is a modified group free association procedure with emphasis upon producing large numbers of "ideas" in the absence of criticism or judgments as to their value. Critical evaluation of "brainstorming" sessions occurs later in order to avoid inhibiting unusual "ideas" during the session.

Although there have been courses established to teach "brainstorming" in business and industrial firms as well as colleges, there is as yet little objective research demonstrating its efficacy.

Taylor, Berry, and Block (1957) found that group brainstorming did not produce a greater number of "ideas" or unique "ideas" as compared to individuals working alone and whose performance was scored as a nominal group. In fact, it was found that the nominal groups were significantly superior to the brainstorming groups under the conditions of their experiment. Corroborative evidence was found in another study by Taylor and Block (1957). These experiments, however, were not designed to study the effects of originality training in groups or by individuals. They provide no information on the problem of training originality, whether giving many different solutions to problems results in an increased probability of giving original solutions to subsequent different problems.

Meadow and Parnes (1959) have recently reported that a course based upon the principles described in Osborn's book (1957) produced a significant increment in originality in its students as compared to a control class taking a different course. But as in many classroom experiments, there is the difficulty of assessing what the relevant variables are, whether it was the training in problem solving per se, or the changes in motivation resulting from participating in a class and studying a procedure which explicitly claims to facilitate problem solving. There are additional difficulties inherent in the study since no attempt was made to control or assess the extent of differential rehearsal of the test materials in experimental and control classes. The experimental class practiced on materials very similar to the originality tests given before and after the courses were taken. Finally, the design employed permits a biased sampling of Ss, since the "creative problem solving" course was an elective one.

The early psychological literature as well as the suggestions of the nonpsychologists reviewed tend to agree upon a small number of different procedures for increasing originality. One training procedure is to present an uncommon stimulus situation, a situation for which common or conventional responses may not be readily available. Relatively uncommon responses may be evoked as a consequence (Slosson & Downey, 1922; Osborn, 1957). A second procedure is the evocation of different responses to the same stimulus situation (Royce, 1898; Osborn, 1957). Under such conditions the successive responses may become more uncommon. A third training procedure is the evocation of the uncommon responses as textual responses. Several recent experiments have employed this procedure (Judson, Cofer, & Gelfand, 1956; Maltzman, Brooks, Bogartz, & Summers, 1958; Maltzman, Simon, Raskin, & Licht, 1960) and will be discussed shortly. Instructions, as distinguished from training, may also be used to increase originality, and appear to be effective under certain conditions

(Christensen, Guilford, & Wilson, 1957; Maltzman, Bogartz, & Breger, 1958; Royce, 1898).

"Productive" Thinking and Originality

Before turning to the current experimental research on originality training, however, note should be taken of several recent studies that have employed Maier's (1931) two-string or analogous problems as a test situation. The reason for commenting upon these studies is the assumption that there is no fundamental difference in the behavioral principles determining originality and problem solving behavior generally. Both involve the evocation of relatively uncommon responses, otherwise the situation would not be called a problem or the behavior original. This is especially apparent in connection with Maier's two-string problem. Maier (1931) considers the pendulum solution to be a consequence of productive thinking whereas other solutions represent reproductive thinking. As indicated elsewhere (Maltzman, 1955) these problem solving behaviors do not involve fundamentally different laws as demanded by Maier, but only a difference in the extent to which initial response hierarchies are modified. Furthermore, as far as can be determined this also is the basis that Maier used for distinguishing reproductive from productive solutions. The former solutions were given by his Ss upon the initial presentation of the problem. Only after these solutions were given and the Ss were told to find still another solution, which happened to be the pendulum solution, did Maier call it productive thinking. The empirical basis for the distinction between reproductive and productive thinking, then, was the probability of occurrence of the solution under his experimental conditions. The pendulum solution was relatively uncommon and is original in this sense.

Several studies have attempted to determine, with some success, whether verbal responses necessary for the solution of a subsequent problem are present in the initial response hierarchy of Ss (Saugstad, 1955; Saugstad & Raaheim, 1957; Staats, 1957). The determination is made by obtaining word associations to objects later found in the problem situation. Responses necessary for the solution of the problem are presumably uncommon, have a low probability of occurrence in the initial response hierarchy. An association procedure has also been used to determine the uncommonness of responses evoked in the initial response hierarchy and their relation to subsequent success in the two-string problem (Maltzman, Brooks, Bogartz, & Summers, 1958).

A series of experiments by Judson, Cofer, and Gelfand (1956) is a limiting case of the use of textual responses in facilitating "productive" problem solving or originality. They employed the two-string problem as the test and rote learning as the training situation. Instead of attempting to increase the occurrence of uncommon responses during training and determining their transfer effects in the test situation, they induced directly the response chain necessary for a pendulum solution to the problem. A group form of the two-string problem was employed, and the Ss were required to write as many solutions as possible to the problem of grasping both strings simultaneously. The design of the experiment was to prompt a pendulum solution to the problem by presenting an experimental group with different lists of words, one of which contained the relevant response chain "rope," "swing," "pendulum." Additional control group were employed receiving word lists including none of these words, one or all three but each in a different list. In this study as well as in two replications, the experimental group was superior to the control groups, although the differences were not always statistically significant. A further qualification is that these results hold only for men. No reliable differences were obtained among women in the various conditions. An analogous experiment was conducted employing a group form of Maier's hat rack problem, and comparable results were obtained. These studies suggest that repeated evocation of the critical words during rote learning increased the probability of their occurrence in the problem situation which in turn lead to an increased frequency of the desired problem solution.

Another related study has been reported by Flavell, Cooper, and Loiselle (1958). Their study was designed to demonstrate that "functional fixedness" could be reduced by evoking uncommon responses to an object during a pretest period. In one respect it is more pertinent to the problem of producing relatively nonspecific transfer than the studies by Judson, Cofer, and Gelfand (1956), because the responses evoked during the pretest period were not the appropriate ones in the subsequent test problem. However, for our purposes the experiment suffers the limitation that it does not show an actual facilitation of problem solving performance but only a reduction in "functional fixedness."

A series of studies by Maltzman, Brooks, Bogartz, and Summers (1958) combines features of both of these experiments (Judson et al., 1956; Flavell et al., 1958) by evoking uncommon textual responses during a pretest period which are not involved in the problem solution in any obvious manner. Evidence of facilitation was obtained under these conditions. A screwdriver and a block of balsa wood were the objects available for use in the problem situation. Only the screwdriver was sufficiently heavy to serve as a weight permitting a string to swing in pendulum fashion. In the first experiment a control group was given the test problem without any pretraining. Lists of unusual uses for a screwdriver, balsa wood, and string were read by the experimental group before they performed in the problem situation. None of the uses referred to operations involved in the experiment. It was nevertheless found that the experimental group solved the problem significantly faster than the control group, and these results held for both sex groups. Additional experiments with modifications in the lists of unusual uses also obtained reliable differences between experimental and control *S*s, but typically in the case of women and not the men. Many variables in this experimental situation are in need of further analysis. However, the inherent lack of reliability of the two-string problem as a test and the difficulties involved in obtaining experimental control over the relevant variables in the situation suggest that more fruitful studies of originality and problem solving generally should employ another type of experimental situation. Also, with respect to the study of originality, test problems of this sort usually involve uncommonness of response only by inference or by definition. A more direct measure of originality would be highly desirable.

Current Studies of Originality Training

Because they seemed to meet the desired requirements, tests of originality of the kind developed by Guilford (1950) and his associates (Wilson, Guilford, & Christensen, 1953) as well as earlier writers (Hargreaves, 1927; Slosson & Downey, 1922) were chosen for a more detailed experimental analysis of variables involved in training originality by Maltzman and his associates (1958, 1960).

In the first experiment in this series (Maltzman, Bogartz, & Breger, 1958) the *Ss* were run individually. All of the subsequent studies were conducted in group form. A modified free association procedure was employed in which the stimulus words were selected on the basis of their restricted response hierarchies. Since a relatively small number of different responses are evoked by the stimuli, a high degree of communality occurs among their responses. A control group received an initial list of 25 words to which they gave free associations and a different final list of 25 words to which they gave free associations. This was followed by the Unusual Uses Test of originality (Guilford, 1950). The latter test consists of a series of names of six common objects for which *S* must give different uses other than their common everyday use.

An experimental group received the same treatment except that the initial list was presented five additional times with instructions to give a different response on each repetition. A second experimental group was treated in the same fashion except that *E* said "good" after every approximately fifth uncommon response during training. Each of these three groups was subdivided prior to the introduction of the free association test list. Half the *Ss* in each condition were instructed to try to be as original as possible, and half were told nothing. Each of these subgroups were further subdivided prior to administration of the Unusual Uses Test and instructed to be as original as possible. These latter instructions may have been redundant, if not confusing, since the written instructions to the test already implied as much.

Originality measures were obtained for performance on the free association list by determining the frequency with which the responses to each stimulus word occurred. The mean frequency of his associative responses was taken as each *S*'s originality score. Thus the lower the score the more uncommon are *S*'s responses on the average. The total number of unique responses given to the items was taken as the measure of originality on the Unusual Uses Test, where a unique response was defined as a use occurring only once in the sample. Results of the experiment showed that both training and instructions produced a significant increase in originality on the free association test list. What is more, the experimental subgroups receiving training in addition to instructions were significantly more original than the control group receiving instructions alone, indicating that the training may produce its effects independently of instructions to be original. Results obtained from the Unusual Uses Test were ambiguous, yielding a significant triple order interaction where the experimental subgroup without originality instructions was significantly more original than its control group. However, results on the Unusual Uses Test from subsequent experiments have consistently shown reliable training effects.

Despite the above evidence indicating that the training procedure facilitated originality, additional information is needed to determine precisely what characteristics of the procedure are responsible for the effect. Differences between the experimental and control groups may have been due to the difference in number of stimulus words presented, number of responses evoked, number of different responses evoked, etc. The fact that different responses were evoked by the same stimuli may be neither necessary nor sufficient for an effective training method. Additional research was therefore conducted in an attempt to isolate the relevant variables.

In one study (Maltzman et al., 1960) the control condition and the experimental condition without verbal reinforcement or instructions to be original were again employed. The latter group received instructions to give a different response to each presentation of the same stimulus word. For convenience they will be called the standard control and experimental conditions, respectively. Two additional experimental groups received lists of 125 different stimulus words, the same number as the repetitions of the initial list for the standard experimental group. One group received high frequency count stimulus words while the other group was presented with relatively low frequency count words (Thorndike & Lorge, 1944). This procedure equated the experimental groups for the total number of different responses. They differed in that the responses all occurred to different stimulus words in the new experimental conditions whereas different responses occurred to the same stimulus words in the standard experimental condition. Another control group was added which received the same number of repetitions of the initial list as did the standard experimental group, but these Ss were instructed to try to give the same response at each repetition of a given stimulus. This condition would aid in determining whether the number of responses per se, or the number of different responses, is the relevant variable influencing test performance.

Results from the free association test of originality showed that the three experimental groups did not differ significantly from each other and the two control groups did not differ significantly. But each of the experimental groups was significantly more original than each of the control groups. On the Unusual Uses Test the standard experimental group did significantly better than all the other groups. The two experimental groups receiving different stimulus words during training did not differ from the standard control group, while the new control condition was significantly less original than each of the other conditions.

The results from this experiment indicate that under some conditions the evocation of a relatively large number of different responses to different stimuli may increase originality to the same extent as the method of repeated evocation of different responses to the same stimuli. However, the two methods apparently differ in the extent to which they produce transfer effects, as indicated by the significant difference between the two methods on the Unusual Uses Test. These results show that the evocation of different responses to the same stimuli is an important aspect of the standard experimental procedure, although arousal of many different responses by different stimuli is also effective, within limits.

The significant loss of originality by the new control group was not entirely unexpected, and shows that a training technique can significantly decrease as well as increase originality, a result which is of theoretical interest as well as suggestive for classroom practices. Exactly why the effect should appear on the Unusual Uses Test and not on the preceding free association test is not clear, and is a problem that requires further experimental investigation.

Another experiment (Maltzman et al., 1960) was designed to further explore possible relevant variables and alternative procedures for facilitating originality.

The standard control and experimental conditions were again employed. Another experimental condition was given repeated presentation of items from the Unusual Uses Test in order to determine whether the effectiveness of the training procedure is limited to only certain kinds of materials. This was accomplished by presenting the list of six items a total of six times with instructions to give a different use prior to each repetition. A different kind of training procedure was employed with a third experimental group. They were presented with a booklet consisting of 125 different pairs of words. The Ss were instructed to indicate the member of each pair which goes more readily with the stimulus word orally presented to them. The same stimulus words and number of repetitions as employed with the standard experimental conditions were administered. Each pair of words were unique responses to the stimulus words selected from the previously established norms. A fourth experimental group was given the word pairs and asked to indicate which member of each pair they thought to be more familiar. The stimulus words were not presented. Results of the free association and Unusual Uses Tests showed that the standard experimental condition was significantly more original than the other four groups on both tests, while the other groups did not differ significantly from each other.

In one of the new conditions uncommon responses were evoked as textual responses following the stimulus words. In the other condition only the textual responses occurred. These conditions were introduced in order to determine whether the uncommon responses must be evoked by the stimulus words in order for the training to be effective. The fact that these groups were significantly less original than the standard experimental group suggests that, at least with the training and test materials employed, uncommon responses must be evoked as intraverbal responses by the stimulus words if there is to be an increase in originality in the test situations.

Since the experimental condition which received original training with items from the Unusual Uses Test failed to show a significant training effect, another experiment was conducted to determine whether the failure was due to an inadequate amount of training. Four conditions were employed in this study receiving different amounts of training. None of the groups showed a significant increase in originality on the free association test when compared with the standard control condition.

Results from the latter experiment and one condition from the previous experiment showed that training with unusual uses items in the same fashion as word association materials does not produce a comparable increase in originality. Thus the method of repeated evocation of different responses to the same stimuli does not work with all materials.

A basic assumption of our approach is that, if original behavior can be induced to occur repeatedly through some training procedure, it will increase in its frequency of occurrence in new situations. If this condition is not met, transfer of originality to new situations cannot occur. Inspection of the unusual uses training data indicated that an appreciable increase in originality did not occur during training. In the case of training with free association materials a marked increase does take place.

Another experiment was conducted in which different groups received 0, 1, 5, or 10 repetitions of the initial word association list before testing on another word association list and the unusual uses. A significant trend was evidenced on both originality tests, with a single repetition of the training list producing a significant increase in originality (Maltzman et al., 1960).

On the basis of the current dearth of relevant information, we can only speculate as to why training with unusual uses failed to induce an increase in the uncommonness of the responses. One hypothesis that may be offered is based upon the apparent relatively limited number of different uses available for each item. Given the instructions to write a different use to each repetition of an item and the inability of Ss to do so with a different operant, they respond with essentially synonymous uses repeatedly, a condition, as we have already seen, not likely to facilitate originality.

If, as we have assumed, originality can be learned according to the principles of operant conditioning, then the effects of originality training should be of the same kind as those ordinarily obtained in experimental studies of learning. One of the gross characteristics of learning is that the behavioral changes produced by reinforcement persist for some time, are not relatively transistory. Increased originality induced by the training method previously described should therefore also persist. An experiment designed to investigate this property of originality training has been conducted, and positive results have been obtained (Maltzman et al., 1960). Using the standard control and experimental conditions of the previous experiments, a delay of approximately one hour was interposed between the training and test situations for a control and an experimental group, and a delay of two days for another control and experimental group. A significant training effect was obtained on the word association and the Unusual Uses Test of originality.

These results show that the effects of originality training persist to a significant degree for at least two days, under the given experimental conditions. We may conclude from these results and that of the previous experiment that the standard experimental procedure for training originality produces some kind of learning.

Relation of Originality Training to Learning to Learn

Originality training studies of the kind reviewed here and learning to learn studies (Duncan, 1958; Harlow, 1949; Morrisett & Hovland, 1959) have the common characteristic of producing relatively nonspecific transfer effects. Training on given stimuli transfers to other stimuli in the absence of any obvious opportunity for the operation of primary stimulus generalization. Despite the apparent similarity between the results of training in learning to learn and those discussed here, differences in the experimental operations and the kind of behavior induced in these procedures suggest that different principles are involved in these situations.

The learning to learn procedure involves the learning of a great many different discrimination problems. Different stimuli are presented repeatedly until *S* has learned a differential response to a criterion or has received a given number of trials. The responses are not varied and uncommon responses are not reinforced, nor can they be, because a specified response is correct. Under these conditions Ss show a progressive decrease in the number of trials required to learn new discrimination problems. In originality training, on the other hand, variability of response is induced. Repeated presentation of the same stimuli and reinforcement of a specific predesignated response likewise does not occur in originality training. In learning to learn, the stimuli vary from problem to problem, but the responses do not. In originality training and test situations the stimuli and the responses vary. Thus the two procedures differ in terms of the operations employed to induce nonspecific transfer. Furthermore, the interpretations offered by Duncan (1958) in his comprehensive study of learning sets at the human level do not appear applicable to originality training. The acquisition of observing responses, habits of looking at details of stimuli, etc. are important in discrimination problems but do not appear to be particularly relevant in originality training situations of the kind described here. Likewise, the analysis of learning to learn by Morrisett and Hovland (1959) in terms of the discrimination between stimulus trace patterns does not appear applicable to originality training.

An Interpretaton of Originality Training

Two basic problems, not unrelated, posed by the experiments on originality training by Maltzman and his associates (1958, 1960) demand an interpretation. First is the nature or source of the reinforcement for originality. In all of the experiments, successive training trials in the standard experimental conditions are accompanied by increases in the uncommonness of the responses. The originality induced in this manner transfers to different stimulus materials, and these effects tend to persist. Originality training thus produces behavioral changes that are characteristic of learning, yet they occur in the absence of differential reinforcement administered by *E*. Nevertheless, we believe that uncommon responses received differential reinforcement. Reinforcement was obtained, because the occurrence of any previously established intraverbal association is self-reinforcing. As Thorndike puts it: "The mere occurrence of a connection strengthens it" (1949, p. 23). Thus, where there is an initial probability greater than zero that a given verbal stimulus will evoke a verbal response in an operant situation such as word association, the occurrence of that response will increase the probability of its occurrence on a subsequent presentation of that stimulus. Different initial conditions may only increase or decrease the amount of reinforcement affecting the stimulus-response connection. In the type of experimental situation with which we are concerned here, the uncommonness of the response evoked by the stimulus is one of these conditions. In other words, the amount of reinforcement is inversely related to the initial probability of a verbal stimulus evoking a verbal response. Originality is more reinforcing than commonplace responding.

An impression gained from observing Ss in the experimental situation is that repeated evocation of different responses to the same stimuli becomes quite frustrating: Ss are disturbed by what quickly becomes a surprisingly difficult task. This disturbed behavior indicates that the procedure may not be trivial and does approximate a nonlaboratory situation involving originality or inventiveness, with its frequent concomitant frustration. This impression of frustration accompanying the task of producing repeated uncommon responses would lend support to the notion that when such responses do occur they are self-reinforcing to a considerable degree. These speculations, however, are not essential to the investigation of the initial hypothesis of the self-reinforcing character of uncommon responses. However, these as well as other considerations suggest that the distribution and scheduling of the evocation of uncommon responses may be of great importance in determining the extent to which a transfer effect will be obtained.

It should be noted, however, that the role of self-reinforcement is probably less significant in producing an increase in originality during training, the successive repetitions of the same word list, than in the test situation. Since instructions to the standard experimental group prohibits the reoccurrence of the same response to a given stimulus word, successive responses to that word will be progressively lower in the related response hierarchy. This is sufficient to account for the increase in the uncommonness of responses with successive repetitions of the same stimulus words. However, we believe that a second variable contributes to the increase in originality during the training session, generalization of the reinforcement effects from the evoked response to still more uncommon responses in the same hierarchy. However, the role of self-reinforcement becomes significant when the transfer of originality to the test situations is considered. In this case the carrying out by *S* of previously administered instructions to give different responses will not account for the greater originality of the standard experimental condition in the test situations.

This leads to the second problem presented by the experimental data: the fact that the evocation of uncommon responses on one list of stimulus words facilitates the occurrence of original responses on a different list of words, and even more perplexing, on the rather different Unusual Uses Test. The problem is to account for the fact that reinforcement of one instance of original behavior increases the response tendency for other instances of such behavior under different stimulus conditions. A relatively nonspecific kind of transfer of training is induced. Without it, the facilitation of originality would not be possible.

We do not have any simple rigorous explanation of this phenomenon at the present time, but offer the following tentative suggestions. The intraverbal associations possessed by a normal educated adult are enormously extensive and complex. In all likelihood, almost every verbal response is associated to some extent with every other. Furthermore, the intraverbal associations among common verbal responses are stronger than between common and uncommon responses. Likewise, the intraverbal associations among uncommon responses are relatively stronger than between uncommon and common. The evocation and reinforcement of uncommon responses will, through complex kinds of mediated generalization, therefore increase differentially the probability of occurrence of other uncommon responses even though they do not ordinarily occur to the same stimuli as the original reinforced responses. In a similar fashion, the evocation of common responses would differentially increase the probability of occurrence of other common responses even though they may be members of different response hierarchies. An additional characteristic of the standard experimental procedure used in originality training is that it provides for the inhibition of common responses as well as the facilitation of uncommon responses. Through mediated generalization the effects of inhibition will produce a decrement in the excitatory potential of other common responses. It is this characteristic which may be responsible for the more general transfer effects obtained with the standard experimental procedure than with the procedures that induce uncommon textual responses or employ uncommon stimulus situations for evoking, in turn, uncommon responses. None of these other procedures would involve the inhibition of common responses.

It should be clear that the foregoing hypotheses are speculative and their connection with the data presented is tenuous. Considerable careful experimentation tracing the intraverbal associations present in the experimental situation is needed as well as the development of laws of verbal compounding before a completely adequate explanation of the basis for originality training can be given. Whether or not such explanations can be given, the method of training originality described in this paper seems worthy of further study in its own right, and potentially may have considerable practical application. This again is a problem requiring sustained experimental research employing different kinds of test materials.

In conclusion, it should be emphasized that little is to be gained by disputing the usage of the term "originality" as it has been employed here, or whether the current experiments described are investigating the essence of originality. The important problem is the experimental one of determining the variables influencing the occurrence of uncommon responses in relatively simple situations and the functional relationships that obtain in these situations. Finally, the extent to which these effects hold for more complex behavioral situations must be determined. Such work is now in progress in the UCLA laboratory. But to designate only highly complex behavior of a given sort as original to the exclusion of simpler better controlled behaviors seems gratuitous, as well as an obstacle to the progress of research in this vital area.

SUMMARY

The basic problem in the training of originality is to devise a means of increasing the frequency of uncommon behavior. Once it takes place it may receive reinforcement and increase the probability that other original behavior will occur. Earlier attempts to devise training methods for originality were briefly mentioned, as well as related studies of problem solving.

A series of experiments by Maltzman and his associates was reviewed, and a procedure which consistently facilitated originality was described. This procedure involves the repeated presentation of a list of stimulus words in a modified free association situation accompanied by instructions to give a different response to each stimulus. Under these conditions the responses become more uncommon. When presented with new stimulus materials, Ss receiving such training are reliably more original than Ss receiving no training. Tentative suggestions as to the behavioral bases for the training effect were given.

REFERENCES

Barnett, H. G. *Innovation: The basis of cultural change*. New York: McGraw-Hill, 1953.

Barron, F. The disposition towards originality. *J. abnorm. soc. Psychol.*, 1955, **51,** 478–485.

Christensen, P. R., Guilford, J. P., & Wilson, R. C. Relations of creative responses to working time and instructions. *J. exp. Psychol.*, 1957, **53,** 82–88.

Dennis, W. The age decrement in outstanding scientific contributions: Fact or artifact? *Amer. Psychologist*, 1958, **13,** 457–460.

Drevdahl, J. E. Factors of importance for creativity. *J. clin. Psychol.*, 1956, **12,** 21–26.

Duncan, C. P. Transfer after training with single versus multiple tasks. *J. exp. Psychol.*, 1958, **55,** 63–72.

Flavell, J. H., Cooper, A., & Loiselle, R. H. Effect of the number of preutilization functions on functional fixedness in problem solving. *Psychol. Rep.*, 1958, **4,** 343–350.

Ghiselin, B. (Ed.) *The creative process.* New York: New American Library, 1955.

Guilford, J. P. Creativity. *Amer. Psychologist*, 1950, **5,** 444–454.

Guilford, J. P. Traits of creativity. In H. H. Anderson (Ed.), *Creativity and its cultivation.* New York: Harpers, 1959.

Hargreaves, H. L. The faculty of imagination. *Brit. J. Psychol. Monogr.*, 1927, No. 10.

Harlow, H. F. The formation of learning sets. *Psychol. Rev.*, 1949, **56,** 51–65.

Judson, A. J., Cofer, C. N., & Gelfand, S. Reasoning as an associative process: II. "Direction" in problem solving as a function of prior reinforcement of relevant responses. *Psychol. Rep.*, 1956, **2,** 501–507.

Lehman, H. C. *Age and achievement.* Princeton: Princeton Univer. Press, 1953.

Maier, N. R. F. Reasoning in humans: II. The solution of a problem and its appearance in consciousness. *J. comp. Psychol.*, 1931, **12,** 181–194.

Maltzman, I. Thinking: From a behavioristic point of view. *Psychol. Rev.*, 1955, **62,** 275–286.

Maltzman, I., Bogartz, W., & Breger, L. A procedure for increasing word association originality and its transfer effects. *J. exp. Psychol.*, 1958, **56,** 392–398.

Maltzman, I., Brooks, L. O., Bogartz, W., & Summers, S. S. The facilitation of problem solving by prior exposure to uncommon responses. *J. exp. Psychol.*, 1958, **56,** 399–406.

Maltzman, I., Simon, S., Raskin, D., & Licht, L. Experimental studies in the training of originality. *Psychol. Monogr.*, 1960, **74** (6, Whole No. 493).

Meadow, A., & Parnes, S. J. Evaluation of training in creative problem solving. *J. appl. Psychol.*, 1959, **43,** 189–194.

Mearns, H. *Creative power: The Education of youth in the creative arts.* New York: Dover, 1958.

Morrisett, L., Jr., & Hovland, C. I. A comparison of three varieties of training in human problem solving. *J. exp. Psychol.*, 1959, **58,** 52–55.

Osborn, A. F. *Applied imagination.* New York: Scribner's, 1957.

Royce, J. The psychology of invention. *Psychol. Rev.*, 1898, **5,** 113–144.

Saugstad, P. Problem-solving as dependent on availability of functions. *Brit. J. Psychol.*, 1955, **46,** 191–198.

Saugstad, P., & Raaheim, K. Problem-solving and availability of functions. *Acta Psychol.*, 1957, **13,** 263–278.

Slosson, E. E., & Downey, J. E. *Plots and personalities.* New York: Century, 1922.

Springbett, B. M., Dark, J. B., & Clarke, J. An approach to the measurement of creative thinking. *Canad. J. Psychol.*, 1957, **11,** 9–20.

Staats, A. W. Verbal and instrumental response hierarchies and their relationship to problem-solving. *Amer. J. Psychol.*, 1957, **70,** 442–446.

Stein, M. I. Creativity and culture. *J. Psychol.*, 1953, **36,** 311–322.

Taylor, C. W. (Ed.) *The 1955 University of Utah research conference on the identification of creative scientific talent.* Salt Lake City: Univer. of Utah Press, 1956.

Taylor, C. W. (Ed.) *The second (1957) University of Utah research conference on the identification of creative scientific* *talent*. Salt Lake City: Univer. Utah Press, 1958.

Taylor, D. W., Berry, P. C., & Block, C. H. *Does group participation when using brainstorming facilitate or inhibit creative thinking? ONR 150–166, Tech. Rep. 1* 1957, Dept. Industr. Admin. and Dept. Psychol., Yale Univer.

Taylor, D. W., & Block, C. H. *Should group or individual work come first on problems requiring creative thinking when equal time is devoted to each? NR 150–166, Tech. Rep. 1* 1957, Dept. of Indust. Admin. and Dept. Psychol., Yale Univer.

Thorndike, E. L., & Lorge, I. *The teach-connectionist's psychology*. New York: Appleton-Century-Crofts, 1949.

Thorndike, E. L., & Lorge, I. *The teacher's word book of 30,000 words*. New York: Columbia Univer. Press, 1944.

Van Zelst, R. H., & Kerr, W. A. Some correlations of technical and scientific productivity. *J. abnorm. soc. Psychol.*, 1951, **46,** 470–475.

Wilson, R. C., Guilford, J. P., & Christensen, P. R. The measurement of individual differences in originality. *Psychol. Bull.*, 1953, **50,** 362–370.

26.

The Associative Basis of the Creative Process*[1]

Sarnoff A. Mednick

. . . We will state our basic hypothesis regarding the nature of creative thinking in the form of a definition. With these introspective statements serving as background, we may proceed to define the creative thinking process as the forming of associative elements into new combinations which either meet specified requirements or are in some way useful. The more mutually remote the elements of the new combination, the more creative the process or solution. An additional criterion of the level of creativeness of a product is described below.

Creative thinking as defined here is distinguished from original thinking by the imposition of requirements on originality. Thus, 7,363,474 is quite an original answer to the problem "How much is 12 + 12?" However, it is only when conditions are such that this answer is useful that we can also call it creative. There are many original ideas expressed in institutions for the mentally ill and mentally retarded; few of these are likely to be creative. There are many fields of creative endeavor in which the usefulness of products would be difficult to measure reliably. While these difficulties must eventually be faced, for the present our research efforts have been concentrated on laboratory situations in which criteria for usefulness can be arbitrarily experimenter-defined and unequivocally explained to the subject. The originality of a response is simply inversely related to its probability in a given population.

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* From S. A. Mednick, The associative basis of the creative process, *Psychol. Rev.*, **69**, 220–232 (1962). Reprinted by permission of the author and the American Psychological Association.

[1] The essence of this paper was written while the writer was a Visiting Research Psychologist at the Institute of Personality Assessment and Research, University of California, Berkeley. The author wishes to acknowledge his indebtedness to Benton J. Underwood for his encouragement and the stimulation of his paper, "Orientation to research on thinking" (1952). Work on this material has been supported by the Cooperative Research Program of the Office of Education (Project No. 1073) and the National Science Foundation (Grant G-3855).

It should be pointed out that this definition of creativity is quite similar to basic notions advanced by British associationists from Locke (1690) to Bain (1855), and by those psychologists whose work is based in large measure on their speculations. Freud (1938), Hollingsworth (1928), and Binet (1899) may serve as examples.

Ways of Achieving a Creative Solution

In terms of associative theory, we may point to three ways of achieving a creative solution. Generally, any condition or state of the organism which will tend to bring the requisite associative elements into ideational contiguity will increase the probability and speed of a creative solution. Therefore, the following three ways of attaining creative solutions are all methods of bringing the requisite associative elements together.

SERENDIPITY

The requisite associative elements may be evoked contiguously by the contiguous environmental appearance (usually an accidental contiguity) of stimuli which elicit these associative elements. This sort of creative solution is often dubbed serendipitous. This is the manner of discovery to which is popularly attributed such inventions as the X ray and such discoveries as penicillin. One physicist has described how he has reduced serendipity to a method by placing in a fishbowl large numbers of slips of paper, each inscribed with a physical fact. He regularly devotes some time to randomly drawing pairs of these facts from the fishbowl, looking for new and useful combinations. His procedure represents the operational embodiment of this method of achieving creative solutions.

SIMILARITY

The requisite associative elements may be evoked in contiguity as a result of the similarity of the associative elements or the similarity of the stimuli eliciting these associative elements. This mode of creative solution may be encountered in creative writing which exploits homonymity, rhyme, and similarities in the structure and rhythm of words or similarities in the objects which they designate. The contiguous ideational occurrence of such items as alliterative and rhyming associates may be dependent on a factor such as primary stimulus generalization. It seems possible that this means of bringing about contiguity of associational elements may be of considerable importance in those domains of creative effort which are less directly dependent on the manipulation of symbols. Here we might include certain approaches to painting, sculpture, musical composition, and poetry.

MEDIATION

The requisite associative elements may be evoked in contiguity through the mediation of common elements. This means of bringing the associative elements into contiguity with each other is of great importance in those areas of endeavor where the use of symbols (verbal, mathematical, chemical, etc. . . .) is mandatory. For example, in psychology, the idea of relating reactive inhibition and cortical satiation may have been mediated by the common associates "tiredness" or "fatigue" (Köhler & Fishback, 1950).

Individual Differences

From the definition given above, the factors that will make for individual differences in the probability of achieving creative solutions may be deduced. Any ability or tendency which serves to bring otherwise mutually remote ideas into contiguity will facilitate a creative solution; any ability or tendency which serves to keep remote ideas from contiguous evocation will inhibit the creative solution.

Listed below are several illustrative predictions concerning individual differences that one may make from this theoretical orientation.

NEED FOR ASSOCIATIVE ELEMENTS

It should be clear that an individual without the requisite elements in his response repertoire will not be able to combine them so as to arrive at a creative solution. An architect who does not know of the existence of a new material can hardly be expected to use it creatively.

ASSOCIATIVE HIERARCHY

The organization of an individual's associations will influence the probability and speed of attainment of a creative solution. There is a whole family of predictions that one may draw from this concept of the associative hierarchy. As an initial example, let us take the question of the manner in which the associative strength around ideas is distributed. If we present an individual with the word "table," what sort of associative responses does he make? The individual who tends to be restricted to the stereotyped responses, such as "chair," may be characterized as having an associative hierarchy with a steep slope (see Figure 1). That is, when you get past the first one or two conventional responses to the stimulus, the individual's associative strengths to other words or ideas (lower in the hierarchy) drops rapidly. We can also conceive of a second sort of individual whose associative hierarchy is characterized by a rather flat slope. This is an individual who perhaps also has as his strongest response the conventional chair. But for him this response is not overly dominant and so it is more likely that he will be able to get to the less probable, more remote kinds of associations to table. It is among these more remote responses that the requisite elements and mediating terms for a creative solution will be lurking. This slope factor may be related to the mathematical analysis of associative production developed by Bousfield, Sedgewick, and Cohen (1954). It probably is closely approximated by their constant, m, measuring rate of depletion of the associative reservoir. They found a high negative correlation between rate of association and total number of associations. It would be predicted from Figure 1 that the high creative subject (flat hierarchy) would respond relatively slowly and steadily and emit many responses while the low creative subject (steep hierarchy) would respond at a higher rate but emit fewer responses.

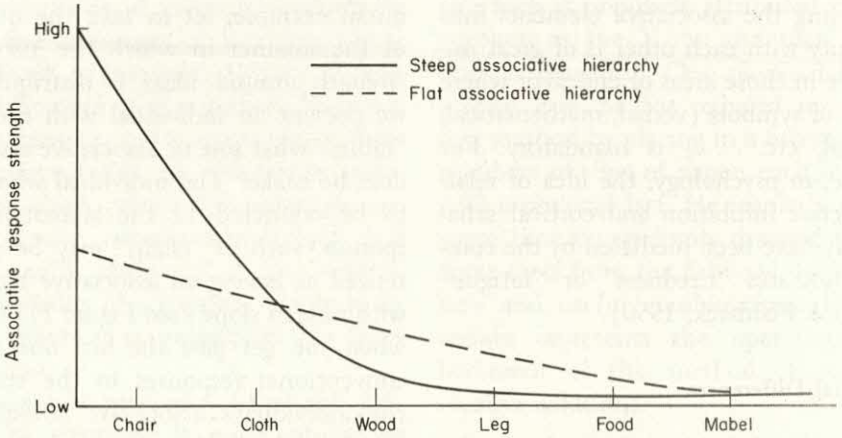

FIG. 1. Associative hierarchies around the word "table." From Mednick: Associative basis of the creative process.

It would be predicted that the greater the concentration of associative strength in a small number of stereotyped associative responses (steep hierarchy) the less probable it is that the individual will attain the creative solution. Thus, the word association behavior of the high creative individual should be characterized by less stereotypy and commonality. This last prediction is supported by a study by Mednick, Gough, and Woodworth (Mednick, 1958). Research scientists rated for creativity were divided into relatively high ($N = 15$) and relatively low ($N = 15$) groups. The low creatives gave more stereotyped responses on 80% of a group of 36 test words from the Kent-Rosanoff list. (These test words were chosen for their tendency to elicit stereotyped responses. Stereotypy was defined by the Minnesota Kent-Rosanoff Word Association Norms, Russell & Jenkins, 1954). It should be pointed out that these results lend themselves to another possible interpretation. The highly creative individual may also have a steep hierarchy but a deviant one. That is, his most dominant associative response may be quite strong but quite different from the popular, dominant associative response. There are different predictions that can be made for the flat-associative-hierarchy creative and the steep-deviant associative-hierarchy creative. The latter is more likely to be the one-shot producer (a not uncommon phenomenon among novelists). If he does create further products, they will tend to resemble closely the first product. The former is more likely to be a multi-producer; he is more likely to produce in a variety of avenues of creative expression.

The prediction suggesting an expectation of less creativity from an individual with a high concentration of associative strength in a few responses leads to another prediction. The greater the number of instances in which an individual has solved problems with given materials in a certain manner, the less is the likelihood of his attaining a creative solution using these materials. Such an individual will "know the meaning" of the elements of the subject matter. That is, he will have a steep associative hierarchy around these elements. An example of the operation of this principle recently occurred to the writer while teaching an honors freshman introductory course in psychology at the University of Michigan. I was giving a well known interpretation of a well known experiment in stimulus generalization when interrupted by a student who calmly stated that the interpretation was in error. After a few minutes of blustering I asked him to explain. His explanation proved him to be correct. I had been dealing with this material for years and "knew" the "correct" interpretation; for him this material was new, he had a low, flat associative hierarchy. Thus, if a newcomer to a field has the requisite information, he is more likely to achieve a creative solution than a long-time worker in the field. This may be the reason that theoretical physicists and master chess players are often said to have passed their prime by the age of 25.

NUMBER OF ASSOCIATIONS

The greater the number of associations that an individual has to the requisite elements of a problem, the greater the probability of his reaching a creative solution. This variable is not independent of the preceding one since an individual with a high concentration of associative strength in few associative responses is not likely to have a proliferation of associations. The more associates which are evoked by a requisite element of a problem, the more likely it is that an associate will exist which will serve as a mediating bridge to another requisite element, facilitating combination. It seems likely that this variable will not be related to speed of creative solution since it may take a good deal of time to get to the mediating links. . . .

REFERENCES

Bain, A. *The senses and the intellect.* 1855.

Binet, A. *The psychology of reasoning.* Chicago: Open Court, 1899.

Bousfield, W. A., Sedgewick, C. H. W., & Cohen, B. H. Certain temporal characteristics of the recall of verbal associates. *Amer. J. Psychol.,* 1954, **57,** 111–118.

Freud, S. Wit and its relation to the unconscious. In, *The basic writings of Sigmund Freud.* New York: Modern Library, 1938.

Hollingsworth, H. L. *Psychology: Its facts and principles.* New York: Appleton, 1928.

Köhler, W., & Fishback, J. The destruction of the Müller-Lyer illusion in repeated trials: II. Satiation patterns and memory traces. *J. exp. Psychol.,* 1950, **40,** 398–410.

Locke, J. *Essay concerning the human understanding.* 1690.

Mednick, S. A. An orientation to research in creativity. (Res. Memo. No. 2) Berkeley, Calif.: University of California, Institute of Personality Assessment and Research, 1958.

Russell, W. A., & Jenkins, J. J. The complete Minnesota norms for responses to 100 words from the Kent-Rosanoff Word Association Test. Technical Report No. 11, 1954, University of Minnesota, Contract N8 onr 66216.

27.

Unaware of Where's Awareness: Some Verbal Operants–Notates, Monents, and Notants*

William S. Verplanck

For some years now, problems of "learning without awareness" have arisen in a number of contexts; they have created a theoretical–and sometimes an experimental–fuss. Willy-nilly, those who investigate human operant behavior sooner or later are among those involved, whether they have leaped, slipped, or been dragged into the fray. These seem to be the avenues by which participants enter into scientific controversies, as well as into barroom brawls.

The courses of development of these two kinds of controversy are rather similar. They show a certain orderliness. In both, as the dispute rises in heat, and the blows–or experiments–get exchanged at higher rates, the original issue tends to get lost, if there was one to begin with. In the present case, the issue summarizes itself in "You can't," "I can," in progressively stronger inflections. Just what can or cannot be done either has been omitted, or repeatedly redefined, as the controversy has extended itself. It is not surprising that seemingly contradictory results turn up. To this writer, the present dispute, which seems to have something to do with the subject's ability to state experimental contingencies, is a regrettable one. As it has developed it seems to have led to the performance of experiments on inappropriate forms of behavior, and to a proliferation of speculative theory.

By inappropriate forms of behavior, I mean this: the experiments that have been–by now–repeated over and over with only minor modifications are those that have confounded at least two questions, the identification of response[1] classes and the stability (habituability) of reinforcers. "Saying plural nouns," "constructing sentences in the first person," "Mm-hmm," and "Good" may serve to demonstrate the occurrence of operant conditioning, but they are not necessarily the best choices for experiments on other problems. Statements about whether or not operant conditioning occurs must depend upon the changes in behavior that occur with reinforcement and its withdrawal, and not upon anything the subject may have to say about it. (It should also be superfluous to point out that the terms "voluntary" and "operant" refer, by and large, to the same behaviors.) Many psychologists, in pursuing thought along these lines, seem to have tended to adopt ever more subtle (but not stringent) definitions of "awareness" and to have introduced theory in inverse proportion to the clarity of their experimental findings. Some seem to believe that if they can somehow demonstrate something that can be tagged with the label "awareness," they have in some sense found an "explanation" for the orderliness of human conditioning.

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* From W. S. Verplanck, Unaware of where's awareness: Some verbal operants—notates, monents, and notants, in C. W. Eriksen (ed.), *Behavior and awareness,* Durham: Duke University Press, 1962. Reprinted by permission of the author and the Duke University Press.

[1] For the usage of the terms *response* and *stimulus,* see stimulus (3) in the writer's glossary (Verplanck, 1957). See also Stimulus III (Verplanck, 1954); and Gibson (1960).

One would not express discomfort with this state of affairs if it were not for the fact that this seems, at least to the writer, the wrong time to attempt to use "awareness" as explanatory, or descriptive, of much of anything. The fact is, very little is suggested as to how "awareness," however it may have been defined, can or does control or affect behavior in the first place. Statements about "awareness" as prerequisite to learning have shown little, if any, experimental unity, and the word seems to have become a label indicating an explanatory dead end. However the issues as they have thus far been stated were resolved, little new information would be added.

The word seems to be associated with a rather special kind of phenomenological approach to behavior. While this may seem somewhat heretical to those phenomenologically oriented, to the writer it has always seemed that when the experimental facts get established, their phenomenological aspects seem to take care of themselves.

Some years ago, E. J. Green (1955) remarked that each of his subjects in a discrimination experiment could figure out its correct basis only once. The writer had made much the same observation during human conditioning (Verplanck, 1956). In the latter experiments, many subjects have a good deal to say while being conditioned; some of what they say is to the point. That is, some of it corresponds to the experimenter's rules in conditioning the subject. Both these observations related rather directly to subjects' behavior in a number of exploratory experiments on discrimination and "concept-formation" that the writer had been doing. In these, while seeming to behave in conformity with continuity theory, the subjects always did a lot of "hypothesizing" (again, some of it to the point) à la the Tolman-Krechevsky school. Even the writer, resent it though he may (as a Spencian incrementalist at the time), found that he "hypothesized" when serving as a subject. Self-observation, however, yielded few clues as to what was going on.

The common link seemed to be this: in all cases, the subject could come across the correct rule, the "solution," only once in any experiment. Only once could Green's subjects catch on to the critical dots that were correlated with reinforcement. Only once could the conditioning subjects "catch on" that "touching the nose with the right forefinger" produced a point. Only once could subjects figure out that pictures of "objects that can be used in transport" were to be put in the pile on the right. The correct rule, once said, hung on, the problem was solved (ten successive correct choices), and the experiment terminated.

The "aha" that came is this: in operant conditioning of rats and pigeons, too, the subject is observed to "solve the problem" only once. Thereafter he "applies the solution." In shaping bar-pressing or key-pressing, the skilled experimenter finds very quickly that he is dealing with a one-trial event. The first bar-press that yields the click of food dropping into the magazine, and then the rat's quick dive toward it (a Guthrian affair), is followed in most cases by another bar-press, after an interresponse time that is no greater than those that are later recorded after 10 or 100 reinforcements. Where this does not occur, it seems that the experimenter, not the rat, made the mistake. We may look back at Estes' paper on conditioning (Estes, 1950). To attain a clear-cut incremental process in bar-pressing, he found it necessary to introduce a second bar; gradual changes in pressing bar 1 occurred while extinction to bar 2 was going on. One might put it this way: incremental processes in conditioning seem always to involve extinction, either of the response itself to stimuli other than the one the experimenter has chosen, or of a competing response. With proper experimental control, operant conditioning is a "once" affair; subsequent reinforcements serve primarily to maintain it at strength, and to develop resistance to extinction, which might be characterized as "reluctance to give up the solution." At the time these considerations were asserting themselves, the writer was busy defining "response" for a glossary, and was struck both by the restrictions that this empirical definition placed on the kind of behavioral events to which the term applied and by the extraordinary range of new behaviors which could experimentally prove to be responses, behaving, under discriminative and reinforcing stimuli, in a simple manner.

All this suggested an approach to some of the problems raised by human behavior, and especially by verbal concepts. Let experimental work seek to establish directly how the verbal behavior occurring in an experiment is related to the other behaviors that occur. Verbal behaviors, if overt, meet the behaviorist's demands for experimental data, and while they can hardly be expected to bear a one-to-one relationship with concepts of "awareness," "hypotheses," "mediators," and the like used by others, there can be no dispute that they have something to do with at least part of what may be meant by "awareness." So, we sought to make a direct experimental attack upon the problem of how verbal behavior acts under the effect of various environmental conditions, and how it in turn is related to the motor behaviors with which it is, at least linguistically, associated. Just how closely such verbal behaviors may relate to "awareness" must be left to those who are surer than I of what is referred to by the word.

Specifically, we undertook to investigate the "rules"[2] that subjects say to themselves, and try out in various experimental problems. So long as these are allowed to remain covert, the experimenter forfeits the opportunity to exert direct experimental control over them. If they are made overt, the experimenter can directly subject them to environmental contingencies, as he can other behaviors. The ways in which they are controlled by antecedent or consequent stimuli can be determined by straightforward and simple experimental methods. We should be able to determine how they occur in response to environmental events, how they serve as discriminative stimuli for other behaviors, and how they alter in strength with reinforcement.

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[2] Since this paper was given, a monograph (Shepard, Hovland, & Jenkins, 1961) has appeared in which the results of experiments on much more complex problems of the same class are reported. It is encouraging to note that data were gathered on the rules—the notants—that subjects eventually came up with. But no effort was made to determine experimentally their origin, and their history through differential reinforcement. It is the behavior of such "rules" that this paper deals with.

Our first guess was that overt verbal statements of "rules" would prove to be simple operant behaviors, conditionable as are other operants. Preliminary experimentation based on this proposition led to methods that have since been further developed. The first method is a simple one: it requires the subject in a "concept-formation" card-sorting experiment to state aloud, on each presentation of a stimulus-object, the "rule" that he is following in trying to get as many cards as possible correctly placed to right or left. In this situation, where many different possible rules may apply, the experimenter is able to make social reinforcement ("Right" or "Wrong") contingent either upon the particular statement made by the subject, or upon the behavior that the statement instructed the subject to perform. In either case, he may deliver it *after* the placement.

Preliminary experiments determined the selection of the stimulus material and the problem. Stimulus materials which permit the experimenter to choose any one of an almost unlimited number of possible "solutions" proved indispensable. The experimenter must be free to change the "solution" of any problem in midstream—he must be able to make wrong what was previously right, and right what was wrong. He must have far more latitude than provided by, say, the Weigl cards. Second, the material must not require the acquisition of names (the acquisition of a single new response to an arbitrary class of events; stated conversely, the acquisition of a new stimulus class. See Shepard *et al.*, 1962). Third, the behavior required should not press the subject's immediate memory span.

The Dissociability of "Rule" and Behavior

The results of these experiments led us to choose as the first formal experiment one that seemed to place maximal demands on the proposition that subjects' "hypotheses" are simple operants. We (that is, Stuart Oskamp [1956] and the writer) chose to show that these would occur at a high relative frequency even under partial reinforcement, under conditions where we could also keep track of the behavior presumed to be controlled by them.

Stimulus materials consisted of a set of 110 children's "trading cards"[3]—backs of playing cards, each different from all the others. Single objects or figures were represented on 55 of these, and 55 had two or more objects pictured. The subjects' task was, given the cards one at a time, to place each either to the right or to the left. The instructions also told the subject that he could get all of them correctly placed. Three groups of college students were run. Members of all three groups, *P*, *P*H, and P*H*, received the instructions to place each card to either right or left. Two of the groups, *P*H and P*H*, received the further instruction to state on each trial the rule followed in attempting to get the card right, before placing it. The first group, *P*, and one of the latter two groups, *P*H, were told "Right" or "Wrong" on each trial according to whether the card was placed correctly. The third group, P*H*, was told "Right" or "Wrong," according to whether they had stated a specific version of the rule followed by the experimenter in reinforcing, regardless of where they placed the card. (In group designations, the italic indicates whether P [placement] or H ["hypothesis"] was reinforced.) For all groups, reinforcement with "Right" or "Wrong" was given only after the card was placed.

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[3] The tremendous variety in trading cards, on which pictures and designs vary in innumerable dimensions, and which may be further varied, independent of their individuality, by presenting them to the subject upside down, sidewise, or the like, makes such procedures possible. There are an effectively infinite number of possible rules that the experimenter can follow in giving reinforcement, and among which he can shift, whether he is reinforcing monents or placements. Similarly, their variety permits the experimenter to select stimulus materials with considerable free-

In order to assure that any experimental results obtained could not be accounted for in terms of partially correct hypotheses, only a limited subset of the rules that could produce consistently correct placements was positively reinforced in members of group P*H*. That is, we shaped a particular set. The rules differentially reinforced for group P*H* were all of the form: "Single (one) principal object (figure, design) to the right, two (more than one, several, two, three) principal objects (figures, designs) to the left." If the subject, in stating the rule, *named* the object or objects pictured, he was told "Wrong." He had to use an abstract term. Records were kept, trial by trial, both of placements, and, for groups *P*H and P*H*, of rules stated.

The procedure was this: acquisition trials were carried out as usual in this type of concept-formation experiment (continuous reinforcement of correct responses) until the subjects met the criterion of ten successive correct responses. Thereafter, with no change in instruction to the subject nor any other indication of an alteration in procedure, all subjects were placed on a partial reinforcement schedule, in which they were told "Wrong" following each incorrect response, and following four out of each successive ten correct responses (placements for P and *P*H; rule statements for P*H*). On the remaining 60 per cent of correct responses, they were told "Right." These positive reinforcements were given according to a predetermined randomized schedule.

This schedule places the correct rule-statement on partial positive reinforcement, and at the same time punishes incorrect rule-statement 100 per cent of the time. The strength of correct rule-statement will depend, then, on reinforcement by avoidance, on partial positive reinforcement, or on both. Any of these provides accrual of strength by conditioning processes.

Many statements that subjects in group P*H* could make would lead them to place the cards consistently in the correct pile (e.g., "one dog, belongs to the right," "two dancers go to the left"), but these

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dom and control, although never with the degree of control provided by "artificial" materials, such as the Weigl cards. This flexibility seems indispensable for finding the orderly behavior of our subjects.

were not reinforced, since they did not correspond with the rule-statement required by the experimenter. For members of group *P*H, if such "Wrong" statements were followed by placements consistent with them, they would be followed by reinforcement contingent on the correct placement.

The results of this experiment were clear. First, although the mean number of trials to criterion was smallest for group *P*H, such differences among groups were not reliable. Several subjects in this group first stated a correct rule following three or four consecutive correct placements. But our primary interest is in the behavior under partial reinforcement. Of the placements made by subjects in groups *P* and *P*H on reinforcement trials 51 through 100[4] following the ten trials in the criterion run, 60 per cent were reinforced, and for P*H* 58.9 per cent of correct placements followed instances of the correct rule that were reinforced. The percentages of correct placements under partial reinforcement were, respectively, 71.2, 71.8, and 76.8, which differ significantly from chance (50 per cent), but not from one another. On the 23.2 per cent of the trials on which members of P*H* made incorrect placements, these subjects were reinforced 43.9 per cent of the time; that is, with 4 of every 10 incorrect placements, they stated the correct rule, the one for whose statement they were being reinforced. More striking are the percentages of trials on which (*a*) the correct rule, (*b*) rules that were incorrect, but yielded correct placements, (*c*) rules that related to the objects pictured, rather than to other features of the stimulus material (borders, colors, realism, and the like), were stated by members of *P*H and P*H*, the two groups giving the rules on each trial. These are summarized in Table 1.

The data of the table indicate clearly that the rule that has been, and continues to be differentially reinforced, occurs at high relative frequency. Its relative frequency is higher than that of the behavior it is presumed to control. Although P*H* subjects state the correct rule on 92.2 per cent (and one or another version of it on 94.2 per cent) of the trials, they

TABLE 1

Percentages of Trials 51–100 on Which Members of Groups PH and PH Stated Each of Four Categories of Rules

CATEGORY OF RULE STATED	GROUP *P*H	GROUP P*H*
(1) Correct rule	30.2	92.2
(2) Other version of rule that would yield correct placement consistently	18.2	2.0
(3) Incorrect rules that named object depicted	17.2	0.2
(4) All others	34.4	5.6

From Verplanck: Unaware of where's awareness: Some verbal operants—notates, monents, and notants.

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[4] Through the first 50 trials, the percentage correct drops from 100 per cent to an asymptotic value. The rate at which this occurs varies from subject to subject, evidently as a function of differences in the aversiveness of the socially presented "Wrong."

place the cards correctly on only 76.8 per cent of the trials. In other words, they do not place the card where they say they are going to on 17.4 per cent of the trials. Group *P*H, however, states the correct rule, or a version of it, on 48.4 per cent of the trials, but places the cards correctly on 71.8 per cent—a discrepancy of 23.4 per cent in the other direction. The rule-statement, and the behavior for which it is presumably a discriminative stimulus, have been dissociated by manipulating their contingencies of reinforcement.

In a later experiment by Rilling (1962) on the reinforcing properties of "Right" and "Wrong," one group underwent an experimental procedure which replicated that of group *P*H. He obtained results almost identical with those of Oskamp (1956): on 72.8 per cent of the trials, the placement was correct; on only 57.1 per cent of the trials was any version of the experimentally correct rule given.

The results may be summarized as follows: under partial reinforcement, the statement of a specific rule retains considerable strength, as do simple operants. The strength is, in fact, greater than that of the behavior that the rule is presumed to control—here, the placement of a card. Where reinforcement is contingent on placement, a higher percentage of correct placements occurs than can be accounted for by correct rules. Experimentally, the subject's rules, his "hypotheses," can be dissociated to a degree from the behaviors that they are presumed to direct. He does not carry out his intentions.

The Monent

In fairness both to theorists, and to the conceptual system within which this experiment was done, it is now necessary to introduce a term for these "statements-of-a-rule" by our subjects. They must be distinguished from the "hypotheses" referred to in many theories and from the rules followed by the experimenter in conducting the experiments. The term chosen is "monent," derived from a Latin verb meaning "advising, guiding, or directing," and it is "monents" that now become subject to a number of experiments aimed at determining further how subject's verbal behavior acts in controlling other of his behaviors. The outcome of this experiment leads, also, to further methods of investigating such verbal behaviors, and hence to data that have shown their status as operants, their discriminative stimuli, and the kinds of events that reinforce them. For clarity of exposition, we will reserve the words "rule" and "principle," for the rules followed by the experimenter. Let me summarize very briefly a variety of experiments, in the approximate order in which they were done, with a brief account of the immediate context in which they were performed. All of them are based upon the experimental method of shifting the basis of reinforcement from monent to monent, from monent to placement according to one or another rule, from placement to placement, and back again.

A. Extinction and Recovery

In order to determine how monents behave under extinction, we performed a number of experiments using the same stimulus materials, the same set of instructions as those given to groups *P*H and *PH*, and the same general method.[5]

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[5] Many of these effects can be obscured by averaging the data of subjects. It is the individual subject whose behavior is or-

A simple demonstration comes when one gives the subject instructions to state the rule he is trying before each placement, and then tells him "Wrong" on every trial. Latencies of monents increase progressively, more and more improbable monents occur when they are finally given ("can be used to carry opium" is the writer's favorite), and finally the subject gives up—"I can't think of anything else"; "my mind's a blank," and so on. Only very rarely does a subject come up with the one paradoxically reinforceable monent: "*Anything* I say is going to be wrong!"

Extinction with spontaneous recovery occurs when the experimenter delivers reinforcement according to the following rules: reinforce five consecutive times the second monent stated by the subject (i.e., the moment first stated by the subject on the second trial); extinguish this monent thereafter, but give five consecutive reinforcements to the second new monent given after the last instance of the first reinforced monent. Repeat this shift in reinforcement two more times until each of four different monents has received five consecutive reinforcements, then shift to reinforcement of placement according to a rule that does not correspond with any of subject's monents. Under these conditions, subjects will eventually reach the criterion of 100 per cent correct placement, but the monents they state typically resemble closely the initially reinforced four. These recur, to be re-extinguished and again to recover spontaneously. The subject often is never able to state the rule followed by the experimenter in reinforcing placements, even though he reaches 100 per cent correct. Under these conditions, subjects may take several hundred trials to reach solution.

B. The Monent as a Chain of Responses

The protocols of this and of similar experiments show that the monent is a chain composed of two responses, made up of a word or phrase descriptive of the card, the "notate," linked to an instruction, the "predocent" such as "put to the right," or "goes to the right." A notate may not recur after a single unreinforced occurrence. If the subject says "people go to the right" and gets no reinforcement, he is not likely to try "people go to the left"; he is more likely to say something such as "cards with blue go to the right." The two parts of the monent thus may be separated; their initial strengths differ greatly, as does their resistance to extinction.

A "notate" (Latin—roughly translatable as "what has been observed") is defined as follows: any word or phrase given in response to a stimulus or to an object incorporating stimuli. Notates can be further characterized as "descriptions," "associations," "discriminated responses," "descriptive characteristics," "categories," or even "verbal percepts." Notates are stimulus-controlled and are symbolic of one or another feature of the stimulus.

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derly. Combining the data of many subjects serves not only to force discontinuous data into a guise of continuity, but it also yields a degree of variability that leads one to seek "significance" by placing more and more subjects in each group, rendering it still less likely that one will either observe carefully the behavior of any one individual or sharpen up the experimental design. Subjects *do* differ from one another, and in ways that make group data treacherous.

They are synonymous, then, with Skinner's (1957) "tact."

The second part, "put to the right," "goes to left" termed the "predocent" (roughly "instructing beforehand"), is defined as a verbal response that is an S^D for motor behavior. (One might expect that there would be a third member of the chain, "is correct." Such occur very rarely.)

C. Some Response Equivalences, and Lack of Them

In some experiments, subjects have been permitted to say "same." If, after a series of "sames," the subject is asked what "same" means, he gives the monent last stated. That is, the subject's "same" can be believed, and reinforcing "same" gives results identical, insofar as can be determined, with those obtained by reinforcing the last previously stated monent itself. Another effect should be noted: reinforcing "borders go to the left" is *ordinarily* equivalent to reinforcing "nonborders go to the right." Under some circumstances in placement reinforcement, which we would hesitate to try to characterize as yet, the two may be dissociated, and the subject may systematically say, "borders to the left," and "animals to the right," depending on the stimulus card presented. That is, monents may adventitiously become differentially reinforced with respect to stimuli. The effects of the adventitious reinforcement of "borders" when presented with cards having borders are not incompatible with those of the adventitious reinforcement of "animals" to cards with animals, and to cards with both borders and animals.

Again under circumstances that have not yet been determined, subjects may show a perfect discrimination for placements to the right, and show no discrimination of placements to the left, without respect to the strength of any monent. In these cases, some cards that belong on the right are being put to the left, and the S^D for right placement has not yet become identical to that feature of the stimulus cards which the experimenter has chosen. For the subject, the S^D is a subclass of the stimulus the experimenter has chosen.

D. The Discrimination Process: Extinction of Placements to S^Δ

Further analyses were made on the data obtained on individual subjects in groups P and *PH* of the initial experiment, and on subjects in other experiments following similar procedures. In these, cumulative frequencies of placements to the right are plotted as a function of cumulative instances of S^D (i.e., the class of cards that belong on the right according to the experimenter's rule) and of S^Δ for this response. A similar pair of curves is plotted for placements to the left. These curves show that incorrect card placements (the two S^Δ-R curves) fall off in extinction curves. Under *PH* instructions, the correct monent tends to occur for many subjects only after considerable extinction has taken place. When this occurs, the extinction process is short-circuited out, and the extinction curve takes a slope of zero at once. But considerable (and recoverable) resistance to extinction for either R in the presence of their S^Δ's remains, to reveal itself in "careless errors."

These results emphasize the fact that monents are not discriminated, but, once they occur correctly, may be reinforced on every trial thereafter, whereas placements to the right or to the left can be reinforced only when their discriminative stimuli (cards that go to right and to left respectively) are presented. Placements seem governed by Spencian laws, based on differential reinforcement with respect to two sets of stimuli, that is, with reinforcement of correct and nonreinforcement of incorrect responses with respect to their stimuli. The correct monent, by contrast, as in simple operant conditioning, is reinforced on every trial, irrespective of the particular stimulus presented, and single reinforcements yield immediate repetitions. Both continuity and noncontinuity theories are substantially correct—but for different behaviors. However, unless reinforcement of monents is experimentally distinguished from that of placements, the correct monent will "take over" as soon at it occurs, and will obscure the gradual development of a discrimination.

E. DIFFERENTIAL REINFORCEMENT OF MONENTS

It should be possible to place monents under discriminative control by making reinforcement of a particular monent contingent upon the presence of a particular discriminative stimulus. Thus, under S^D (as experimenter leaning forward or the card presented sidewise) "people to the right, nonpeople to the left" can be reinforced, and under S^Δ (experimenter sitting up straight or the card presented straight up and down) "cards with borders go to the right, nonborders to the left." (This is evidently the "conditional hypothesis.") Experiments of this sort were done, and, the expected discrimination curves for the monents were found.

F. MANIPULABILITY OF AVAILABILITY OF MONENTS

When subjects are used in a series of experiments, with the reinforced monent varied from time to time, there are large transfer effects. An initially improbable monent may appear first in a new experiment, if it has been reinforced in an earlier one. Subject's repertory of monents, and their relative probabilities, may be manipulated over a wide range ("salience").

G. COVERT MONENTS

It should be emphasized that no assertion has been made that the spoken monent is the only verbal behavior involved. Subjects show many signs of covert verbal behavior, and much of this becomes overt when the experimenter asks questions. The subjects' answers often yield additional notates and monents different from what was given aloud, or give elaborated versions of the overt one: "I was wondering if it had something to do with alternate piles, too," or "It may be a particular *kind* of people." These previously unstated monents (where the subject is not following the experimenter's instruction to him) may pick up a few reinforcements adventitiously.

The final experiments of this series deal with covert monents directly.

H. CONDITIONING OF COVERT MONENTS, AS SUPERSTITIONS

An experiment was designed to determine whether a covert event that corresponds in its behavior with the monent occurs. Subjects, run together in sets of five before an audience, have been given the following instructions: "You will be shown a series of pictures. Following a simple rule, some of them are plusses, and some minuses. Your job is to find the rule that makes each card a plus or a minus. On each trial, write in your data book whether you think the picture is a plus or a minus, and you will be told whether you are right or wrong each time. When you think you know what the rule is, put a check next to your answer on that trial. When you are certain what the rule is, put a double check." The subjects were then individually reinforced according to an arbitrary prearranged schedule, independent of their overt response, although the individuals delivering the reinforcements went through the motions of looking at them, before saying "Right" or "Wrong."

On trials 1, 3, 4, and 7, all subjects were told "Wrong." On all other trials through trial 30, all subjects were told "Right." Over the next 12 trials (31-42), one of each set of five subjects was told "Wrong" once, another 3 times, another 6 times, another 9 times. On the other trials, all were told "Right." In each set, one control subject remained on continuous reinforcement, that is, he was told "Right" on every trial past 7. All subjects were then continuously reinforced for a further 28 trials (to a total of 70). At the end, the subjects were asked to write down the rule that was correct, and how sure they were of it, and, if the rule changed, to write down the second rule, and how sure they were of it. This procedure has been replicated a number of times.

In this procedure, then, reinforcements occur—are "shot in"—at times when a monent should have occurred covertly, but the reinforcement was independent of what the monent might be. Monents could be conditioned, then, as "superstitions." The results indicated that covert monents occur, and that they behave under reinforcement as do overt ones.

1. Every subject reported at least one rule of which he was "certain" or "very sure." The relative frequencies of the monents that were conditioned correspond with those observed of overt monents before differential reinforcement (animals, people, borders, realistic, upside down, single vs. plural, and the like).

2. For the 18 subjects who followed the instruction to check and double check, a median of four consecutive reinforcements (range 1-14) preceded the trial on which they reported that they "thought they knew what the rule was," and a median of five more reinforcements (range 3-22) made them "certain" or "very sure." Of those subjected to partial reinforcement through trials 31-42 an insufficient number of subjects made checks, so that no results can be reported.

3. A single nonreinforcement seldom extinguishes or alters the correct monent after it has been on continuous reinforcement for some time. In general, the greater the number of nonreinforcements, the more different the second covert monent from the first. (Table 2)

4. At the end of the series of 70 cards, every one of the 25 subjects reported being certain of the first rule. Every subject who reported a change in the rule, was either "sure" or "pretty sure" of the second rule as well.

We may state with confidence that monents occur covertly, and that they are then subject to the same laws of reinforcement as when they are overt.

In all these experiments, the behavior of individual subjects was orderly to a

TABLE 2

Number of Changes in Monents Reported as a Function of Number of Nonreinforcements through Trials 31–42 (N = 25)

GROUP	A	B	C	D	E
No. "Wrongs" trials 31–42	0	1	3	6	9
Kind of change					
None	5	2	1	1[a]	0
Minor change[b]	0	3	3	2	2
Complete change[c]	0	0	1	2	3

[a] The subject wrote: "red in background, +. Changed in middle (of series), and went back to original."

[b] Minor changes include (a) simple reversals, additions (original: "persons = +; then persons with horses = +"), contractions (original: living things +, then animals and flowers +), expansions (original: "animals negative" to "live negative").

[c] Complete changes: no relationship between first monent and second, e.g., "borders +, to animals +," and "animals and humans +," to "photos."

From Verplanck: Unaware of where's awareness: Some verbal operants—notates, monents, and notants.

high degree; subject's "thinking" came under experimenter's control in very much the way the behavior of a rat does when a response is being shaped. On the other hand, questioning a subject at the end of these experiments on what he was doing, or what he thought was going on, or how he solved the problem, yields a good deal of verbal behavior that usually corresponds poorly with what the subject had in fact been doing, or how frequently he had been reinforced. It reflects very seldom the environmental variables whose control led this subject to behave as other subjects do under the same procedure. What the subject answers to such questions seems to be most closely related to his behavior over the few trials immediately prior to the questioning, and suggests a short-range "immediate memory." Rationalizing, not reasoning, seems to be the appropriate term. The statements recall the flavor of the introspective protocols given by subjects in the functionalists' experiments at the beginning of the century. One can hear and see what led Watson to behaviorism.

REFERENCES

Estes, W. K. Effects of competing reactions on the conditioning curve for bar pressing. *J. exp. Psychol.*, 1950, **40,** 200–205.

Gibson, J. J. The concept of the stimulus in psychology. *Amer. Psychologist*, 1960, **15,** 694–703.

Green, E. J. Concept formation: A problem in human operant conditioning. *J. exp. Psychol.*, 1955, **49,** 175–180.

Oskamp, S. Partial reinforcement in concept formation: "Hypotheses" in human learning. Unpublished Master's thesis, Stanford Univer., 1956.

Rilling, M. Acquisition and partial reinforcement of a concept under different verbal reinforcement conditions. Unpublished Master's thesis, Univer. of Maryland, 1962.

Shepard, R. N., Hovland, C. I., & Jenkins, H. M. Learning and memorization of classifications. *Psychol. Monogr.*, 1961, **75,** No. 13 (Whole No. 517).

Skinner, B. F. *Verbal behavior*. New York: Appleton-Century-Crofts, 1957.

Verplanck, W. S. Burrhus F. Skinner. In W. K. Estes *et al., Modern learning theory*. New York: Appleton-Century-Crofts, 1954. Pp. 267–316.

Verplanck, W. S. The operant conditioning of human motor behavior. *Psychol. Bull.*, 1956, **53,** 70–83.

Verplanck, W. S. A glossary of some terms used in the objective science of behavior. *Psychol. Rev.*, 1957, **64** (Suppl.), 1–42.

chapter VI

Attitude Learning and Human Motivation

LEARNING APPROACHES to the study of "attitudes" have sprung for the most part from Hull's early formulations, especially from the concept of the *pure stimulus act* already described. The first article to be presented in this chapter is a classic by Doob and represents the beginning of theoretical and experimental analyses of attitudes within the learning framework. Doob considers attitudes to be, primarily, implicit conditioned responses which can mediate other overt responses with respect to the stimulus object which elicits the attitudinal response. The important contribution made by analyzing a field in learning terms is shown by the fact that each of the experimental studies in this section, and some in the next, is influenced heavily by Doob's analysis.

The study by Lott represents an experimental test of Doob's formulation which utilizes the paradigm of mediated generalization. Although the design is quite complicated, the results show that "choosing" objects (attitudinal preference) by color can be affected by conditioning of a reinforcing nature which has occurred to the name of the color—but not to either the object or the color itself. The attitudinal response in this case would have been established solely to the verbal response.

The study by Scott takes Doob's formulation concerning attitude learning and extends it by developing a lifelike procedure in which the attitude response toward an issue is altered by reinforcing verbal behavior (debating) about the issue. Positive reinforcement for verbal behavior with respect to an issue, as would be expected on the basis of the previous analyses, results in the verbal behavior (issue) becoming positively reinforcing, that is, eliciting a positive attitude.

The present author's method for demonstrating that the evaluative meaning response to words can be respondently conditioned was described in Selection 21. It was also indicated that attitude formation can be considered to involve these principles and that the operation of language is heavily involved in the formation and change of attitudes. The next study extends this suggestion and helps integrate the concept of word meaning and attitudes within the framework of respondent conditioning principles. In this study the stimulus word (national name) is again given attitudinal value or positive evaluative meaning (or in operant conditioning terms, conditioned reinforcing value) through pairing the word with other positive meaning words. The national name is never paired with a primary reinforcer. All conditioning is done on a language basis, again supporting the significant implication that one of the important functions of language is the ability to produce verbal and nonverbal stimuli that have attitudinal (or reinforcing) properties.

Thus, to summarize, it has been proposed that neutral stimuli that are paired with conditioned or unconditioned stimuli that have reinforcing value will themselves become conditioned reinforcing stimuli (CS^r). The response the CS^r elicits (which accounts for its reinforcing properties) may be called an attitude, or attitude response, when the stimulus has some social significance. On the other hand, when the stimulus is a word, the response to the stimulus is apt to be called the word's meaning. (As will be discussed in the next section, when the stimulus object is a person in a group, the term group cohesiveness is invoked to describe differences in reinforcing value of the stimulus object.) Thus, each of these important fields of study may be seen to involve the principles of respondent conditioning as these principles account for the development of this important characteristic of the stimuli.

However, the study of attitudes involves not only the principle underlying the *development* of the attitudes, but also the manner in which attitudinal stimuli *function*. In its broadest sense, the study of attitudes—and other reinforcing stimuli commonly described as *values* in social psychology and sociology, *needs* and *interests* in personality theory, and *fetishes* and *urges* in abnormal psychology, to mention a few examples—is the study of human motivation. To fully appreciate the importance of the development of these reinforcing stimuli, as well as to integrate the account with previous discussions, a word must be said of the importance of these stimuli in "shaping" human behavior.

First, a great deal of information is given about the behavior of an individual (or, as we shall see, a group of individuals) when the nature of the reinforcers that are effective for the individual are described, as well as *the rules by which these reinforcers are applied*. For these two types of knowledge will tell us much about the types of behavior that the individual will develop.

For example, in our society some of the stimuli that have a good deal of reinforcing value are social and personal attention, acclaim, and respect; money, fine clothes, expensive cars, and houses; and various tokens such as awards and honors. In our society, also, there are "rules" (not formal or explicit) for the application of these stimuli. That is, they are delivered contingent upon some kinds of behavior but not upon others. Thus, large amounts of these stimuli are delivered contingent upon exceptionally skilled baseball, football, acting, dancing, or comic behaviors, among others. Relatively small amounts are delivered contingent upon the behaviors of skilled manual work, teaching, unskilled manual work, nursing, and many others.

These characteristics of our reinforcing system and its rules of application, to continue with the example, have an effect upon the manner in which behavior in our society is shaped. Consider, thus, a boy who has two classes of skilled behaviors, one a set of intellectual skills consisting of knowledge and well-developed study and scholarly work habits, and the other consisting of some form of fine athletic prowess. Let us say that either behavior could be developed to "championship" caliber. Now, in a situation in which the larger amount of reinforcement is made contingent upon the one behavior, this behavior will be strengthened, and as must be the case, at the expense of the other to the extent that the behaviors are incompatible. In our society, of course, many of the strongest reinforcers are more apt to be more liberally applied to athletic rather than scholarly behavior.

When groups are considered, it would also be expected that the reinforcer system and its rules of application will determine the types of behaviors that are dominant. A society that has a differing set of reinforcers and rules will evidence different behavior over the group of people exposed to that set of conditions. A society, for example, whose reinforcers are made contingent upon scholarly research behaviors to a larger extent than another society will create stronger behaviors of that type, in a greater number of people, than will the other society. In general, all of the different cultural, national, and class behaviors that have been observed in sociology, anthropology, and other behavioral sciences, can be considered to involve this aspect of human motivation—the reinforcer system and its rules of application.

The reinforcer system, including the many social attitudes, must also be considered of great importance in understanding abnormal behavior. An individual who has a markedly different reinforcer system than those in his group is likely to develop abnormal behavior. Thus, the male for whom other males are strong sexual reinforcers is more likely to develop homosexual behaviors, for such behaviors will be strengthened by contact with those reinforcers. The problem of behavioral treatment may thus involve changing the nature of the individual's reinforcer system.

These, of course, are simplified examples and take no account of other variables that will also contribute to the eventual outcome. However, in principle, it can be suggested that the nature of the individual's or group's reinforcer system and the rules of response-contingent application are crucial determinants of individual and group behavior. Thus, a description of those events, and an understanding of the principles by which reinforcers affect behavior would be expected to yield a great deal of knowledge of individual and group behavior. While the above examples, as well as those to follow, involve positive reinforcing stimuli, it should be remembered that the implications hold also for aversive stimuli in the individual's reinforcing system. These stimuli, of course, strengthen behavior that is followed by the removal of the negative reinforcing stimulus.

It should also be indicated here that deprivation and satiation operations would be expected to play an important role in human motivation. It has been shown many times in laboratory study with lower organisms that deprivation of a primary reinforcer increases the reinforcing value of a stimulus. And the results of Gewirtz and Baer in Selection 7 also suggest that the same is true of conditioned reinforcers, with human subjects.

It should be added, based upon this principle, that deprivation and satiation should be capable of affecting the relative strengths of reinforcers in an individual's system. Thus, deprivation of sex reinforcers would be expected to increase the reinforcing value of this class of stimuli, at the expense of other reinforcers in the individual's system. For the adolescent, under this type of deprivation, other reinforcers may be *relatively* weak and the behavior maintained by those reinforcers—study, reading, family activities—may weaken.

Deprivation may also affect the reinforcer system, and thus behavior, in a somewhat different way. When a prisoner is deprived of contact with the opposite sex, the general class of sex reinforcers will increase in relative strength. As a consequence, reinforcers that are more accessible, for example, homosexual contact, will be relatively stronger and may shape behaviors that would be unlikely to occur without the deprivation.

It should be emphasized that in this way each instance of homosexual sex reinforcement would be expected to increase the reinforcement value of members of the same sex through learning, thus further altering the structure of the reinforcement system on a more permanent basis. That is, the members of the same sex could become stronger reinforcers than members of the opposite sex—a circumstance that will tend to persevere once it occurs because learning is permanent until extinction, punishment, or counter-conditioning take place.

Thus, deprivation can affect the reinforcer system in two ways, which can be exemplified by considering two conflicting old saws. "Absence makes the heart grow fonder" may be seen as a description of the effects of deprivation on a person's reinforcement value. On the other hand, "Out of sight, out of mind" might be expected when new people are contacted, as a result of deprivation, under reinforcing circumstances, making the new people stronger conditioned reinforcers. The first saw describes deprivation and its motivational effects on the relative and absolute strength of a reinforcer in the reinforcer system. The second describes the fact that when a person is deprived of one reinforcer he is likely to have experiences that will establish new reinforcers.

Perhaps this indicates to some extent the significant role attitudinal (and other reinforcing) stimuli play in shaping human behavior, and the importance of the principles involved. However, the account of the reinforcing function of stimuli does not complete an account of human motivation. For further details of the author's formulation see Staats and Staats, 1963. As some of the articles in the next chapter will also show, establishing attitudinal (reinforcing) stimuli in the group will affect the behavior of members of the group in an additional way.

One further point: this analysis and the articles that are to be presented in this chapter indicate some of the additional possibilities for the integration of learning principles. That is, a stimulus that would be spoken of as eliciting an implicit attitudinal response can be seen to function as a reinforcer. The manner in which the two approaches lend themselves to a more complete account of human behavior may also be seen in some of the other papers that follow.

28.

The Behavior of Attitudes*

Leonard W. Doob

There is no question that the subject of attitude and attitude measurements is important in sociology and social psychology. Social scientists continue to discuss the nature of attitudes in articles like this, to conduct experiments which show that behavior is affected by attitude, and to measure attitudes for theoretical or practical purposes. The problem of what an attitude is and how it functions, nevertheless, persists and—as many writers on attitudes likewise point out in their introductory paragraph—little explicit agreement is apparent in the published literature.

The purpose of this paper is not to criticize other definitions or usages of the term but systematically, if partially, to relate the concept of attitude to what is known as behavior theory (17).[1] Almost

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* From L. W. Doob, The behavior of attitudes, *Psychol. Rev.*, **54,** 135–156 (1947). Reprinted by permission of the author and the American Psychological Association.

[1] The writer is deeply grateful especially to Neal E. Miller as well as to Irvin L. Child, John Dollard, and Mark A. May for their constructive criticisms. He has promiscuously and deliberately borrowed some of their ideas and, as an insignificant token of his gratitude, herewith absolves them of any responsibility for the final product.

all writers, no matter what their bias, agree that attitudes are learned. If this is so, then the learning, retention, and decline of an attitude are no different from the learning of a skill, a piece of prose, or a set of nonsense syllables; and they must also involve the problems of perception and motivation.

Immediately it is necessary to raise and answer the question as to why a simple, commonsense, ubiquitous concept like attitude should be translated into semitechnical jargon. There are at least two answers to the question. The first and less important answer involves scientific methodology: it is thought desirable to bring as many terms as possible relating to a field of research (in this instance, human behavior) within one universe of discourse. Misunderstandings result from using one set of concepts to describe perception, learning, and motivation on one level and another set on a different level. Even if some sociologists who use the concept "attitude" are not attracted by the terminology of behavior theory and if they remain inclined merely to assume perception, learning, and motivation without inquiring into the details of the processes, unified knowledge concerning human behavior requires that there be a connection between what the sociologist studies or measures and what the psychologist studies or measures. Secondly and of crucial importance, a tentative translation of a term from one level to another and into an already and perhaps better developed theoretical system is fully justified if thereby inadequacies on the higher level can be pointed out. Murray and Morgan (27), for example, have recently shed new light on the nature of attitude by incorporating the closely related concept of sentiment into the former's previous conceptualization of personality.

The procedure to be followed in this paper is as follows:

1. A definition of attitude in behavioral terms will be given. It is felt that such a definition represents an advance beyond the stage of defining an attitude as the subjective counterpart of something in the environment, as a predisposition within the organism, or as being what the attitude scale measures. The psychological implications of the definition will be made clear.
2. The consequences of this definition and the theoretical structure it assumes will then be summarized briefly by calling attention to the factors which should be known to make a completely adequate analysis of attitudes.
3. Illustrative research employing the concept of attitude will be critically examined in terms of these factors. Such a detailed examination seems preferable to surveying the attitude literature in general terms.

Definition of Attitude

Attitude is defined as *an implicit, drive-producing response considered socially significant in the individual's society*. This definition states, in effect, that from the psychological point of view attitude is an implicit response with drive strength which occurs within the individual as a reaction to stimulus patterns and which affects subsequent overt responses. Since psychologists and other social scientists sometimes disagree concerning the nature and attributes of an implicit response of this type, the definition is therefore elaborated and broken down typographically into the phrases and clauses requiring further definition, elaboration, and discussion:

"An attitude is:

(1) "an implicit response

(2) "which is both (a) anticipatory and (b) mediating in reference to patterns of overt responses,

(3) "which is evoked (a) by a variety of stimulus patterns (b) as a result of previous learning or of gradients of generalization and discrimination,

(4) "which is itself cue- and drive-producing,

(5) "and which is considered socially significant in the individual's society."

1. "*An attitude is an implicit response. . . .*" By an implicit response is meant a response occurring within the individual and not immediately observable to an outsider. Motor 'attitudes' like the physical set of the runner before the starter's gun is fired, therefore, are not included within the universe of discourse being analyzed because they are not entirely implicit and hence are instrumental rather than mediating acts. The semantic connection of such sets with the concept of attitude employed by social scientists is considered to be largely fortuitous from an historical standpoint.

Overt behavior that is observable to an outsider may be affected by the evoked attitude but is not here defined as the attitude itself. Attitude refers to the individual's immediate but implicit response to a stimulus pattern and his consequent tendency to respond still further as a result of that implicit response. Such an implicit response may be conscious or unconscious, distinctly verbal or vaguely proprioceptive. What is expressed results not from the attitude alone but represents, as will be indicated, another response in a behavior sequence—an overt one—which is a function of the attitude-response and other tendencies within the individual.

2(a). "*An attitude is an implicit response which is . . . anticipatory . . . in reference to patterns of overt responses. . . .*" An anticipatory response—called also an antedating response by Hull (17, p. 74)—is one which originally preceded another rewarded response and which, as a result of being associated with or producing this reward, has been reinforced so that it occurs before its "original time in the response series" (25, p. 49). If an individual, for example, dislikes a fruit or a person, he tends to avoid eating the fruit or meeting the person. Originally the avoidance occurred only after actual contact had been established and after that contact had proven to be punishing and the withdrawal to be rewarding. When a thorough investigation reveals no actual prior contact, some process of generalization or discrimination must have occurred since all behavior has antecedents. The possibility of exceptions under different psychological conditions must be noted, even in these trivial illustrations: the fruit may be eaten anyhow if the individual is very hungry and the person may be met and greeted if social circumstances so require.

The conditions under which a response moves up in the behavior sequence and becomes anticipatory have so far been determined concretely in relatively simple situations. It has been shown (25, p. 79), for example, that the closer the response is in the series leading to the reward, the more likely it is to be learned and then subsequently to antedate other responses not leading to the reward. This principle suggests why few objects or individuals in society fail to arouse attitudes. Originally the individual has had to react to them or has been taught to react to them in the course of being socialized. One of the responses leading to the goal response (which by definition involves reward or the avoidance of punishment) has implicit components, is reinforced, and is here called an attitude.

2(b). "*An attitude is an implicit response which is . . . mediating in reference to patterns of overt responses. . . .*" Whereas the anticipatory character of attitude indicates its temporal relation to a goal, its mediating attribute calls attention to its functional connection with that goal. A mediating response is made in an attempt to increase the likelihood of the occurrence of reward rather than punishment in connection with a goal response. In reasoning, for example, implicit responses intervene between the original stimulus pattern and the goal response and may assist the individual in achieving that goal. Attitudes can be evoked so easily because as mediating responses involving only language, imagery, or proprioceptive reactions they need not conflict with the overt behavior of the individual or with his environment.

The mediating function of attitude has led May to suggest that attitude is "a kind of substitute goal response" which "arises when the goal response cannot be immediately and easily made" (24). This attribute, which has also been suggested by other writers (e.g., 3, pp. 425–6 and 28, pp. 28–9), does seem to characterize certain attitudes. The individual who dislikes another person is restrained or restrains himself from hurting his antagonist; instead he makes an implicit response involving aggression and feelings of avoidance or repulsion. It is felt, however, that all attitudes cannot be so characterized. The liked object, for example, evokes an implicit response which facilitates rather than acts as a substitute for overt behavior in reference to it. Overt behavior, in short, may be mediated by attitudes almost immediately and there need not necessarily be a conflict or a restraint before the attitude is evoked.

Three consequences arise immediately from this conceptualization of attitude. In the first place, it appears psychologically futile—as Sherif and Cantril have indicated (33, pp. 304–5)—to attempt to classify attitudes. Responses can be characterized in so many different ways that a simple dichotomy or trichotomy usually must be willfully stretched if it is to include all types of behavior. The response defined as attitude might be called positive or negative or be said to involve approach or withdrawal were it not for the fact that these terms then require further definition which cannot be consistently or usefully applied to all situations. Both approach and avoidance, for example, may be but are not necessarily involved in what has been called a neutral attitude or in any attitude for that matter. It seems better, in short, to apply *socially* useful labels to attitude as the need arises, in order to indicate the direction in which the individual thereby is oriented; but it should be clearly recognized that the labels have social and not psychological significance. A psychologically important distinction, however, is that between general and specific attitudes (5), a distinction which refers to the stimulus patterns evoking the response or to the evoked responses.

In the second place, reference is made in the definition to "patterns of overt responses." For reasons hereafter suggested, overt behavior can seldom be predicted from knowledge of attitude alone. Under varying conditions within the individual, a given attitude can mediate a repertoire of overt responses. A favorable attitude toward a social institution, for example, can mediate innumerable responses connected with what is considered to be the welfare of that institution.

Then, thirdly, this definition of attitude emphasizes its acquired or learned character. There are no psychic rays which enable the investigator, even though he be equipped with a poll or a scale, to determine the 'strength' of an attitude, the overt responses with which it has become associated, or its present functioning within the personality. Such knowledge can be obtained only from knowing approximately under what conditions the attitude was acquired in the first place and the extent to which it secures present and future reinforcement. The learning process, therefore, is crucial to an understanding of the behavior of attitudes.

The nature of that process cannot be ignored in a treatise on attitude as it has been by Sherif and Cantril: "Just what the psychological or physiological mechanisms of this learning may be are irrelevant to the present discussion," they write in their articles on "The Psychology of 'Attitudes' " (33, p. 302). It is difficult to see how psychologists can call these mechanisms 'irrelevant' and still contend, as the authors do in the introduction to the same articles, that the 'task' of the psychologist is to "give an adequate account of the psychological mechanisms involved in the formation of an attitude in any individual" (33, p. 295). The authors rest their case by stating that they "do not need to take sides in favor of any learning theory" (33, p. 307). Of course, as they write, "the primary stage in the formation of attitudes is a perceptual stage," which is merely saying that there must be a stimulus and that the stimulus must be perceived before there can be any kind of learning.

In contrast, Allport (1, pp. 810–2) has set the problem of the genesis of attitudes in terms which explicitly suggest the need for learning theory. His often quoted summary of the literature indicates that attitudes may be formed through "the integration of numerous specific responses of a similar type"; "individuation, differentiation, or segregation" of experiences; 'trauma'; and the adoption of 'ready-made' attitudes of others. The genesis of almost any attitude is undoubtedly more or less unique. Society sets the rewards and punishments regarding much of overt behavior; the individual being socialized then is forced into the learning situation; although he reacts to the situation uniquely, one of the end products—the attitude—he may share in large degree with others.

3(a). "*An attitude is an implicit response . . . which is evoked by a variety of stimulus patterns. . . .*" The stimuli evoking an attitude may be in the external world or within the individual. The latter range from a verbal response to an autonomic disturbance or a drive. The existing literature on attitudes testifies to the fact that the stimuli may be various. Such is the assumption behind any attitude scale in which a variety of situations is judged or behind a distinction like that between specific and general attitudes.

The arousal of an attitude involves two traditional problems in psychology, those of perception and learning. The two are interrelated and can be separated only for purposes of analysis. Perception indicates that the individual is responding because he has previously paid attention to or been oriented toward certain stimuli which then affect his sense organs and thus evoke his attitude. Learning in this connection emphasizes the reasons in the past history of the individual which have brought about the bond between the stimulus pattern and the attitude.

Gestalt psychologists especially point out that paying attention and then perceiving occur in many instances as a result of the individual's set to respond: letter boxes are not noticed unless the person has a letter to post, etc. Writers on attitude are fond of recalling that the tradition of set is somewhat hoary in academic psychology, in order to demonstrate their own respectability and their acquaintance with long German terms like *Bewusstseinslage*. In other words, perceiving depends upon drive or set (which orients the individual to respond to certain stimuli and then to respond to them in a particular way) as well as upon the arrangements of the external stimuli. Attitude may be included among the sets determining both the orientation of the individual as well as the kind of perceptual response he makes: The southerner notices incipient aggression in a Negro which a northerner will overlook.

It must be recognized, however, that in some situations the individual's attitude is not evoked until the stimulus has been actually perceived: It affects perception after its arousal but does not orient him originally in the direction of the stimuli involved. The southerner who has learned to discriminate incipient hostility from genuine docility among Negroes can make the discrimination when confronted with a Negro. It is on the basis of this discrimination that his attitude toward the Negro is or is not aroused. If he goes about the streets looking for hostility in Negroes, he may be set to make the discrimination not necessarily by his attitude toward Negroes or by his ability to detect such behavior but by some particular drive which has been previously aroused and which may or may not involve Negroes. To say that he searches for aggression solely because of his attitude toward Negroes is to fail to distinguish him from another southerner who has a more or less identical attitude (so far as content and even 'affect' are concerned) but who has no 'chip on his shoulder.' In this case the sensible problem remains of accounting for the 'chip.'

In controlled experimental situations dedicated to observing the behavior of attitudes, the attention of the subjects is secured by the experimenter not through arousing the attitude being studied but through the evocation of some other drive. Subjects perceived the autokinetic phenomenon of Sherif (30) or they looked at Seeleman's photographs of white and colored individuals (29) because they had agreed to cooperate with the experimenter. This was the drive which oriented them in the experimental situation. Then their attitudes were aroused and these attitudes affected both their perceptual responses and the reports they gave the experimenters. Later on in the experiments, their evoked attitudes may have had sufficient drive strength also to orient them selectively.

3(b). "*An attitude is an implicit response . . . which is evoked . . . as a result of previous learning or of gradients of generalization and discrimination. . . .*" The previous section has indicated the possible relation between perception and the evocation of an attitude and therein it was suggested that an attitude can almost always be aroused by a variety of stimuli. Here it is stated that previous learning determines whether or not particular stimulus patterns will evoke the attitude. Some stimuli come to arouse an attitude after a relatively simple process of conditioning has occurred. As a result of being originally present in the situation, for example, the wrapper of the disliked fruit or the signature of the disliked person may produce an anticipatory response which mediates the goal response of avoiding it or him. Other stimuli evoke or fail to evoke an attitude not because of their presence or absence in previous situations but because they fall along a stimulus gradient of generalization or discrimination. If an individual likes or dislikes one particular Negro, there is stimulus discrimination; if all Negroes are involved, there is stimulus generalization along a gradient, for example, of skin color; if only certain 'types' of Negroes arouse the attitude, there is generalization and discrimination.

Frequently attitudes are thought to be puzzling and mysterious because they can be aroused when the psychologist, the sociologist, the layman, and the individual least expect them to be. The stimulus pattern, for example, may be a word or a sentence, or some other symbol (like a flag, a face, or a gesture) which represents only a portion of the original stimulus pattern. The behavior of attitudes under these circumstances, however, becomes more intelligible when the implications of the "gradient of generalization and discrimination" are understood. This gradient is especially efficacious in the case of attitude since language can readily perform the function of mediating generalization and discrimination. Cofer and Foley (11), for example, are able *a priori* to list over fifty gradients along which generalization or discrimination from a single word can conceivably occur in purely formal (*i.e.*, in non-idiosyncratic) manner. The word 'Negro,' for example, through previously learning may become the one part of the original stimulus pattern which evokes an attitude regarding Negroes. Without any difficulty there can be a semantic gradient including words like 'colored,' 'African,' and the various epithets and appellations applied to this group. Through a slightly more complicated process, eventually 'zoot suit' may arouse the same attitude: if the individual has associated this type of clothing with Negroes, the response of seeing such clothing or hearing its name evokes the internal response of 'Negro' which in turn has the property of arousing the attitude. This phenomenon has been called secondary stimulus generalization or acquired cue value. Similarly, thinking can aid generalization and discrimination.

Cantril in his work on attitudes fails to comprehend this stimulus gradient involved in most if not all learning and conditioning. He states, for example, that what he calls "a standard of judgment" must not be "confused with a conditioned response" (8, p. 25). What he means by "a standard of judgment" or a "frame of reference" he never makes operationally clear, although they seem to be related to attitude since they are employed profusely in his two articles on the subject. It may be that terms like these—to use Cantril's own words in reference to 'conditioning'—are "so loosely employed" that they "explain nothing at all" (8, p. 55). His conception of a conditioned response is indeed narrow: "a specific reaction to a specific stimulus" (8, p. 25). In spite of a general, noncommittal reference in a footnote to a standard book on conditioning (that of Hilgard and Marquis) and an irrelevant quotation from A. N. Whitehead, this simplification of behavior theory leads him to conclude that such a theory is "by no means adequate to explain the apparent meaningfulness of man's experience" (8, p. 56). More specifically, for example, he maintains that the "analysis of the backgrounds of the people who became panicky listening to the Hallowe'en broadcast [of Orson

Welles in 1938] clearly shows that in no way had they been specifically conditioned against Martian invaders' mowing down people on this planet" (8, p. 25). The point of Cantril's study (7), however, is to discover the previously existing attitudes and traits which made people prone to panic or sanity. After discovering many of them with admirable ingenuity, he gives a commonsense 'explanation' of the behavior; *i.e.*, he uses his particular vocabulary to describe what happened (7, pp. 190–201). His failure to apply Chapter 8 of Hilgard and Marquis (15) to his own data prevents him from realizing that at the time of the broadcast people had learned to respond with anxiety to various stimuli as a result, for example, of the 'war scare' associated with the Munich crisis (*cf.* 7, pp. 159–60). Certain Americans, some of whose socio-economic and psychological characteristics Cantril has indicated, apparently generalized from these stimuli to a broadcast which of course they had not previously experienced but which nevertheless was sufficiently similar to other stimulus patterns previously evoking the anxiety. Such individuals 'jumped the gun' by behaving—after their attitudes had been aroused by Mr. Welles and his associates—as they would have in the face of genuine catastrophe.

From experiments in other fields of behavior, Hull states that the amplitude of a response "diminishes steadily with the increase in the extent of deviation . . . of the evocation stimulus . . . from the stimulus originally conditioned . . ." (17, p. 185) and that "The strength of the connections at other points of the zone can be determined only from a knowledge of the strength of the receptor-effector connection . . . at the point of reinforcement and the extent of the difference . . . between the position of the conditioned stimulus . . . and that of the evocation stimulus . . . on the stimulus continuum connecting them" (17, p. 187). Whether or not the principle holds true of attitudes has not been tested, so far as this writer knows. To test it, it would be necessary to know "the stimulus originally conditioned," the gradient along which the various 'evocation stimuli' are located, and whether or not in fact these latter stimuli have never been previously reinforced or extinguished. This could be done only by means of a careful life history of various individuals and by some objective measurement of the strength of the attitude.

At any rate, this generalization of Hull has an important bearing on the strength of attitude. The 'strength' of an attitude is almost as ambiguous as the concept of attitude itself. One type of strength that seems important for predicting future behavior of the individual is the *afferent-habit strength* of the attitude, *i.e.*, the strength of the bond between the stimulus pattern and the response which is here defined as attitude. In these terms the afferent-habit strength of an attitude is a function of the number of previous reinforcements as well as the position along the gradient occupied by a particular stimulus pattern.

4. *"An attitude is an implicit response . . . which is itself cue- and drive-producing. . . ."* Like all implicit responses, attitudes can be said to have stimulus-value, *i.e.*, they arouse other responses. The responses they evoke may indeed be various. They may produce a perceiving response, as has been suggested, and in this sense determine to what other stimuli the individual subsequently responds. They may produce linguistic responses, thoughts, images, or stereotypes. They

eventually have an effect upon overt behavior. Here again reference must be made to the habit strength of the attitude, only this time it is a bond between attitude as a stimulus and a response pattern (implicit or overt), rather than between a stimulus pattern and attitude as a response. This phenomenon will be called the *efferent-habit strength* and, like the afferent-habit strength, it too can be strengthened or weakened through learning. The stimulus-value of attitude suggests why investigators have discovered so many different phenomena—aside from overt behavior—associated with attitude.

The definition of attitude refers to the distinction made by Miller and Dollard (25, pp. 22–3) between the cue- and drive-producing characteristics of a stimulus. The numbers used in counting, they point out, have cue value: the number 'six' is a response to the cue of 'five' and in turn acts as a cue to elicit 'seven.' An attitude has cue-value in the sense that it acts as a stimulus to produce another response, but it also is a drive in the sense that its tension is reduced through subsequent behavior leading to a reward. It is proper, consequently, to refer to the *drive strength* of an attitude as well as to the strength of the bond between the attitude and the responses it evokes. An individual, for example, who has not been thinking of food is shown a picture of a type of food he likes. The picture may be said to evoke his favorable attitude toward the food which is a drive whose goal response is eating. If the secondarily evoked response pattern is only salivation and the thought or statement of how he likes the food, the drive may be considered relatively weak. But if he drops what he is doing and goes out to eat immediately after seeing the picture, the drive is relatively strong.

The strength of an attitude, therefore, may refer to its afferent-habit strength, its efferent-habit strength, or its drive strength. Knowledge of an attitude's direction or content is not equivalent to measuring its strength. The attitude possessed by two people, for example, may be more or less identical in formal content as measured by an attitude scale, but its role in determining overt behavior may be quite diverse. In one individual it may be evoked by a restricted stimulus pattern (specific attitude), it may not be frequently evoked (a weak afferent-habit), or the entire pattern of additional implicit and overt responses may be restricted (a weak drive). Any one or more of these conditions may be different in the second individual. Thus the role of the patriotic attitude in the average citizen is different from the way it functions within a professional patriot. Or within the same individual the patriotic attitude may be more easily and variously aroused and lead more certainly to a greater number of responses during a war than when there is peace.

The fate of an attitude over time—whether it persists or changes—is obviously a function of complicated processes within the individual. At least three factors are involved. The first is the reward or punishment associated with the goal response. An attitude will persist when it is constantly reinforced or it will change when it is partially or wholly extinguished. Its afferent- and efferent-habit strength is then increased or decreased. The efferent-habit strength is a direct function of the frequency with which the attitude has mediated rewarding or non-rewarding behavior as well as of the immediacy and amount of the reward or non-reward. Afferent-habit strength depends ultimately upon efferent-habit strength since reinforcement or non-reinforcement results not from the arousal of the attitude but from the behavior mediated by the attitude; it also depends on the frequency with which particular stimulus patterns have aroused the mediating attitude and the distinctiveness of those patterns. In Hull's words (16), attitudes have the property of 'pure stimulus acts' within a single individual: they are responses which are reinforced "because they, as stimuli, evoke *other* acts . . . which will bring about a reinforcing state of affairs. . . ."

Secondly, there is the factor of conflict with competing drives which may determine the fate of an attitude. The afferent- and efferent-habit strength of an attitude may be great, but its drive strength may be weak in comparison with other attitudes or drives aroused by the same or different stimulus patterns. The individual, for example, may not express his attitude in overt behavior because its expression would be contrary to his general philosophy; but his attitude persists. Finally, there is forgetting which may involve other psychological processes besides extinction through non-reinforcement.

It is possible, consequently, to have an attitude play a less significant role in a personality by diminishing the number of stimuli which evoke it, by having the attitude aroused less frequently, by weakening its drive strength, by setting up stronger competing drives, or by punishing the overt behavior which it mediates. Since the afferent-habit strength is affected by the final goal response, moreover, it follows that the attitude's strength in this respect can remain more or less constant even though its efferent-habit strength vis-à-vis a particular response pattern is weakened: it is only necessary that some reinforcement be obtained by having the attitude mediate other goal responses. The prejudiced individual, for example, can retain his prejudice not by always behaving identically in response to a given stimulus pattern in his society but by behaving differently and with more or less equal satisfaction.

There is a voluminous literature on the subject of attitude change, a good part of which is called experimental (cf. 26, pp. 946–80). In general, the approach has been to subject a group of individuals to a collection of stimuli (like a course in race relations, a motion picture, propaganda analysis, or a visit to an ethnic group in a large American city). Their changes in attitude (if any) are ascertained by comparing their scores on an attitude scale before and after being subjected to the stimuli. Sometimes the changes are compared with those of a control group which has not been so stimulated. It must be said that this type of approach is socially useful but psychologically sterile: it is important to know that lectures or visits do or do not affect students but, except for sporadic attempts to correlate attitude change with obvious factors like intelligence and 'intensity' of the attitude at the outset, no effort has been made to suggest precisely why the attitudes do or do not change. They change, it is said, 'because' the student heard the lecture or met a Negro or saw a motion picture. Obviously the word 'because' is misleading. All that has been demonstrated is a correlation, not a causal connection. Two people with approximately the same attitude and subject to approximately the same stimulus pattern, for example, will be affected differently because different responses, including or excluding the attitude, are evoked within them. Or the overt effect may be the same for different reasons: in one, the afferent strength of the attitude may be altered only in respect to particular stimulus patterns and not to others; whereas in another, the drive strength of the attitude may be reduced. To maintain, therefore, that a course or a contact produces attitude change in a group of individuals (with a large or small sigma) is to state an historically limited conclusion which certainly may be socially useful at a given moment. It is like indicating that the abolition of a slum area diminishes the delinquency rate; it does, but thereby little insight is gained into the nature of delinquency (e.g., why there are delinquents from non-slum areas). Research on attitude change, consequently, is likely to produce superficial generalizations which, being derived so uniquely from particular phenomena, can be applied to future situations only with extreme difficulty.

The psychological aspects of this definition of attitude, finally, can shed some light on another traditional problem: the relation between attitude and stereotype. Numerous studies, especially those of Katz and Braly (18) and of Child and Doob (10), have demonstrated the close connection between the two. The term "stereotype" is loosely employed. Like attitude, it seems to be an implicit response —this is what Lippmann (23) many years ago must have meant by defining it as "the picture in our heads." It becomes an attitude, however, only when it is also drive-producing. An individual, for example, has a favorable attitude toward Great Britain, it is said in over-simplified fashion, because he considers the British "patriotic." If the oversimplified explanation be accepted as valid, some learning process in the past must be presumed. A word like "good" must first have produced a "favorable" response since it was conditioned to a stimulus pattern like parent or food which for other reasons evoked that response. Then "patriotic" became associated with "good" for reasons to be found in the individual's milieu and also evoked that response. "Great Britain" as a stimulus came to produce the response of "patriotic" (the stereotype), a bit of learning doubtlessly also socially conditioned. "Patriotic" thus is a stimulus-producing response which, finally, evokes the "favorable" response to which it has been previously linked. In this instance, the stereotype evoked by "Great Britain" is a mediating response in a long response sequence and does evoke a drive. In like manner, most people in our society reply to the question, "Is the earth round or flat?" by means of some stereotype which produces the word "round." The stereotype appears to have cue- but essentially no drive-value and hence is not an attitude, although the question itself may arouse another implicit response with drive-value (attitude): to reply incorrectly to a simple question is usually non-rewarding.

5. *"An attitude is an implicit response . . . which is considered socially significant in the individual's society."* If attitudes are defined as implicit, drive-producing responses, it is obvious that they thereby are placed within the psychological sub-class of such responses but that simultaneously they are not distinguished from other responses in this group. The other psychological qualifications which have been discussed—their anticipatory and mediating character, the variety of stimuli which evoke them, and the variety of responses they evoke—are also common to other responses which, according to conventional usage, may not be considered attitudes. The rat's aversion to a grid on which it has been shocked is doubtless implicit, it is anticipatory and mediating in avoiding the shock, it can

be evoked by a gradient of stimuli, and it has drive value resulting in other responses which serve perhaps to allay its anxiety; but it is ordinarily not useful to call such a response an attitude. Similarly the human being's favorable disposition toward cream cheese or a style of hat may or may not be called an attitude. Psychologically, therefore, attitude is not and—it is deliberately maintained—should not be distinguished from the larger sub-class of responses to which it appears to belong.

The distinction between attitude and other types of responses can be made not on a psychological but on a social basis: its socially evaluated significance must be considered. The rat's aversion to the grid is not an attitude unless it plays an important part in its behavior in other situations involving rats; from the human standpoint, it is not at all socially significant. The liking of cream cheese or a hat may or may not be considered socially significant: from an overall point of view, it is doubtless trivial and hence not an attitude, although it undoubtedly is of importance to cheese producers and hat manufacturers as well as their clients. The words "socially significant" must be left unspecific, since social values fluctuate from society to society and, within a particular society, over time and in various groups. Almost always the socially significant in a society is evaluated or, more simply, is called "good" or "bad" to indicate its actual or potential effect on people. A useful test to decide whether an implicit response with drive-value is an attitude is to discover whether that response is labelled desirable or undesirable by the individual's contemporaries. In any segment of society at a given moment, people are likely to acquire attitudes because they are subject to similar learning conditions. . . .

REFERENCES

1. Allport, G. W. Attitudes. In *A handbook of social psychology* (Murchison, C., Ed.). Worcester: Clark Univ. Press, 1935. Chap. 17.

3. Bernard, L. L. *An introduction to social psychology*. New York: Henry Holt, 1926.

6. Cantril, H. Experimental studies of prestige suggestion. *Psychol. Bull.*, 1937, **34,** 528.

7. Cantril, H., Gaudet, H., & Herzog, H. *The invasion from Mars*. Princeton: Princeton Univ. Press, 1940.

8. Cantril, H. *The psychology of social movements*. New York: Wiley, 1941.

10. Child, I. L., & Doob, L. W. Factors determining national stereotypes. *J. soc. Psychol.*, 1943, **17,** 203–219.

11. Coffer, C. N., & Foley, J. P., Jr. Mediated generalization and the interpretation of verbal behavior: I. prolegomena. *Psychol. Rev.*, 1942, **49,** 513–540.

13. Doob, L. W. Some factors determining change in attitude. *J. abnorm. & soc. Psychol.*, 1940, **35,** 549–565.

15. Hilgard, E. R., & Marquis, D. G. *Conditioning and learning*. New York: Appleton-Century, 1940.

16. Hull, C. L. Fractional antedating goal reactions as pure stimulus acts. Paper delivered before Monday Night Meeting of the Institute of Human Relations, Oct. 24, 1941.

17. Hull, C. L. *Principles of behavior*. New York: Appleton-Century, 1943.

18. Katz, D., & Braly, K. W. Racial prejudice and racial stereotypes. *J. abnorm. & soc. Psychol.*, 1935, **30,** 175–193.

23. Lippmann, W. *Public opinion*. New York: Macmillan, 1922.

24. May, M. A. A stimulus-response interpretation of "attitudes." Unpublished paper.

25. Miller, N. E., & Dollard, J. *Social learning and imitation*. New Haven: Yale Univ. Press, 1941.

26. Murphy, G., Murphy, L. B., & Newcomb, T. B. *Experimental social psychology*. New York: Harpers, 1937.

27. Murray, H. A., & Morgan, C. D. A clinical study of sentiments. *Genet. psychol. Monogr.*, 1945, no. 32.

28. Richards, I. A. *Science and poetry*. New York: Norton, 1926.

29. Seeleman, V. The influence of attitude upon the remembering of pictorial material. *Arch. Psychol.*, 1940, no. 258.

30. Sherif, M. A. A study of some social factors in perception. *Arch. Psychol.*, 1935, no. 187.

32. Sherif, M. A. *The psychology of social norms*. New York: Harpers, 1936.

33. Sherif, M. A., & Cantril, H. The psychology of "attitudes." *Psychol. Rev.*, 1945, **52,** 295–319; 1946, **53,** 1–24.

29.

Attitude Formation: The Development of a Color Preference Response through Mediated Generalization*[1]

Bernice Eisman Lott

The present investigation of attitude development has had as its major stimulus Doob's 1947 discussion (7) and reinterpretation of the concept. His placement of attitude within the framework of behavior theory and his emphasis on attitude as a learned response to definable stimuli appears to be a more research oriented and potentially fruitful approach to the problem than has been taken in the past. An equally important source of stimulation for this study has come from the work on mediated and semantic generalization, particularly from the work of Birge (2), Cofer and Foley and associates (3, 4, 5, 8, 9), Keller (11), Razran (13, 14), and Riess (15, 16).

An attitude is here defined, as suggested by Doob, as a learned implicit anticipatory response having both cue and drive properties. An anticipatory response is one which originally came after a rewarded response but as a result of being most closely associated with the reward moves forward in the behavior sequence. This results in its "anticipatory" occurrence directly to the external stimulus before its original time in the response series. As a response with stimulus properties, an attitude falls into the class of "pure stimulus acts" defined by Hull (10) as responses whose major function is to serve as stimuli for other acts. It follows, therefore, that once such an implicit response-produced stimulus (r-s) has been established, it can be conditioned to evoke overt behavior. In this way an attitude acts as a mediator of responses. It is these responses, mediated by an attitude, which are measured by attitude questionnaires in attitude experiments, etc.

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* From B. J. Eisman, Attitude formation: The development of a color preference response through mediated generalization, *J. abnorm. soc. Psychol.*, **50,** 321–326 (1955). Reprinted by permission of the author and the American Psychological Association.

[1] This paper is based on a portion of a dissertation, prepared under the guidance of Professor F. Fearing, and submitted in partial fulfillment of the requirements for the Ph.D. degree, U.C.L.A., 1953. The author also wishes to thank Professors Gilhousen, Maltzman, Centers, Seagoe, and Turner for their critical suggestions, and Miss C. Seeds, Principal of the University Elementary School, for her cooperation in supplying the subjects for the reported experiment.

The property of drive value ascribed to an attitude is derived from the fact that an attitudinal response is assumed to produce strong stimulation. Any strong, persistent stimulus is considered by Miller and Dollard (6, p. 30) to constitute a drive. Reduction of the strong stimulus is drive reducing and therefore reinforcing. It is expected, therefore, that any overt response which leads to a significant reduction of the strong stimulus will be learned. Ascribing drive value to attitudes distinguishes them from other implicit, anticipatory response-produced stimuli and is in line with traditional views. Attitudes, wrote Allport (1), "both motivate and guide; they supply both drive and direction." Sherif and Cantril (17, p. 300) offer, as one criterion of an attitude, its affective property. Krech, too, speaks of attitudes as motivational, thus distinguishing them from beliefs (12, p. 152).

Statement of the Problem

The purpose of the present study has been to demonstrate experimentally that attitude formation is amenable to laboratory observation and control, and can be adequately conceptualized and explained by reinforcement learning theory. The general hypothesis of this study can be formally stated as follows: A positive preference or attitude toward an object with which an individual has had only neutral experience can be developed through mediated generalization. In more operational terms, it is predicted that if individuals are taught to attach the same label to two stimuli which differ from one another in all other relevant ways, and if these individuals subsequently have rewarding experience with one of these stimuli, then a positive preference for the other stimulus, as well as for stimuli resembling the latter, will be demonstrable. This type of learning experience follows the general paradigm for mediated generalization. In this study the subjects develop a positive response for a color after being subjected to such a series of learning experiences.

To test this general hypothesis four different test situations, in which a color preference could be demonstrated, were employed. These situations, differing in context, complexity, and social significance, will be described in detail below.

Method

APPARATUS AND SUBJECTS

A wooden stage, 20.5 in. high, 30 in. wide, and 19 in. deep, with a raised, slanted platform, at an angle of about 35 degrees from the horizontal, was constructed and used for the presentation of various stimulus objects to the subjects. An unbleached muslin curtain could be pulled in front or away from the platform in order to hide or expose objects on it. Three small depressions about 8 in. apart were drilled into the platform to serve as receptacles for marbles which were used as rewards during certain portions of the training.

The following stimulus objects were used: (*a*) three wooden *geometrical blocks*, each painted white and .75 in. thick, triangular, circular, and square, respectively; (*b*) three *thin rectangular blocks*, each 2.5 in. by 6 in. and .75 in. thick, painted green, yellow, and black, respectively; (*c*) three metal *jar tops*, 2.5 in. in diameter, also painted green, yellow, and black, respectively; (*d*) three *glasses*, 3.5 in. high, painted green, yellow, and black, respectively; (*e*) three *thick rectangular blocks*, 1.5 in. by 1.5 in. by 4.5 in., painted green, yellow, and black, respectively; (*f*) three white wooden *"nonsense" blocks*, .75 in. thick, and of three different nonsense shapes.

Eighty-one subjects (*S*s) were used, 41 boys and 40 girls, ranging in age from 5 years, 10 months to 8 years, 10 months. All *S*s were attending an elementary school operated by the Department of Education of U.C.L.A. All members of each of the classes used in this study were utilized by the experimenter (*E*), i.e., there was no arbitrary selection of *S*s from within any class. The *S*s were told that *E* had a new game she wanted to try out and that she would play with each of the children in a class, one at a time. Owing to the nature of the school, all children in it were accustomed to observation by strangers and many of them were also accustomed to leaving their classes for some time for testing or other "play"-research purposes.

PROCEDURE

The 81 *S*s were randomly divided into four groups with 9 *S*s in Group I, 18 *S*s in Group II, and 27 *S*s each in Groups III and IV. One third of the *S*s in each group was randomly selected to be trained positively for each of the three colors, yellow, green, and black. The *E* worked with one *S* at a time. Since the name of each *S* had been assigned to an experimental group prior to the start of the experiment, the order in which *S*s came to *E* was not fixed, and either the teacher or the last *S* chose the next *S*.

Part 1. Name learning for the geometrical blocks

Each *S* sat facing *E* and the front of the stage. The *S*s in all four groups were treated alike during this portion of the training. The three geometrical blocks were placed on the stage by *E*, and *S* was told that all three had names which *S* had to discover, the names being "egg" (for the triangle), "car" (for the circle), and "shoe" (for the square). Each *S* was shown one block at a time in a predetermined random order which was the same for all *S*s. When a block was presented, *S* guessed at its name and *E* told *S* if he was right or wrong. The *S* was given as many trials as was necessary in order for him successfully to identify each of the three blocks five times in succession. Each *S* was told that learning the names of the blocks was necessary in order to proceed to the next part of the game during which he could win some marbles.

Part 2. Reward series

Here, too, *S*s in all four groups were treated alike. The geometrical blocks were again placed on the platform and *S* was told that *E* would hide a marble under one of them when the curtains were closed and then ask *S* to guess where the marble was. The *S* was instructed to point to the block under which he thought the marble was hidden and to call the block by its *name*, the name learned in Part 1. When placing a marble under the proper block, *E* was careful to make extraneous noise so that sound would not serve as a reliable cue with respect to the hiding place of the marble.

A marble was always hidden under the same block for any given *S*. For those who were to be trained to prefer green, the marble was always placed under the triangle ("egg"); for those to be trained for yellow, the marble was placed under the circle ("car"); and for those to be trained for black, the marble was always placed under the square ("shoe"). The relative positions of the blocks were shifted per trial according to a random, predetermined order which was constant for all *S*s.

Each time a marble was hidden *S* was permitted only one guess as to its location. If *S* guessed correctly, he kept the marble; if he guessed incorrectly, *E* closed the curtains and hid the marble again, under the same block but in a new position with respect to the other two. The reward series ended when *S* had made six consecutive correct guesses. If the criterion was not reached by the fourteenth trial, a correction procedure was instituted, i.e., when *S* guessed incorrectly, *E* lifted the correct block and showed *S* where the marble was.

The purpose of this part of the training was to provide differential reinforcement for one of the three names ("egg," "car," or "shoe") which *S* had learned in Part 1. This is the only portion of the training in which such differential reinforcement could be obtained.

Part 3. Name learning for the thin rectangular blocks

Immediately after the reward series, *E* presented the three colored rectangular blocks, instructing *S* that one was called "egg" (the green block), one was called "car" (the yellow block), and one was called "shoe" (the black block). The *S* was again asked to discover which block had what name. The procedure followed here was identical to that followed in Part 1 and again *S*s in all four groups were treated alike.

Part 4. Review series. Groups I and II

Immediately following Part 3, *S*s in both of these groups were tested for recall of the names of the geometrical blocks and of the colored rectangles and for recall of the marble game (reward series).

Groups III and IV. For *S*s in these groups a longer and more elaborate review was given in order to introduce more reward and color-naming experience. This was done because the results of a preliminary investigation had led to the conclusion that owing to the nature of the test situations (to be described below) given *S*s in Groups III and IV, additional reward and naming experience would be necessary for mediated generalization to be demonstrable.

The *E* presented three new stimuli, the colored jar tops, and asked *S* to guess what their names were. The *S* received a marble each time he correctly named all three stimuli. When *S* reached the criterion of three correct identifications, the colored glasses were presented and the same procedure was followed. The *E* next presented the three thick rectangles and asked *S* to guess their names. Correct identifications were calling the green objects "egg," the yellow ones "car," and the black ones "shoe."

The *S*s were then reviewed on the marble game (reward series). Then one jar top, one glass, and one rectangle, each of a different color, were presented. All three of the possible combinations were presented successively and S was asked to name the objects. No marble rewards were given.

Part 5. Test for mediated generalization and color preference

Here the major differential treatment for the four experimental groups was introduced. The tests were given immediately after the review.

Group I. The Ss in this group were presented with the three thin rectangular blocks used in Part 3 and told, "Now we'll play the marble game with these. You tell me where you think the marble is. Don't forget to tell me the name of the block you think the marble is under." With the curtains hiding the platform, *E* placed a marble under each block. Only one trial was given, and after *S* made his choice he was told that there would be no more games. A right choice was picking that colored rectangle which had the same name as the geometrical block under which *S* had consistently found marbles in Part 2.

Group II. The Ss in this group were also told that they were going to play the marble game again. The curtains were drawn, but instead of placing the three thin rectangles on the platform, as was done with Group I, *E* substituted three new stimuli, the colored jar tops, with which Ss in Group II had had no prior experimental experience. A marble was placed under each jar top. When the curtains were opened, *S* was told to choose that jar top under which he thought a marble was hidden and to give its name ("egg," "car," "shoe"). The *E* did not tell Ss that these were the names of the new objects, and Ss had had no experience in so naming them. Only one choice trial was given. A correct choice was picking that jar top which was the same color as the rectangle which *S*, in Part 3, had learned had the same name as the geometrical block under which marbles had consistently been found in Part 2.

Group III. The Ss in this group were presented with three new stimuli, the white "nonsense" blocks, and instructed that one was called "green," one "black," and one "yellow." The *S* was told that he had to discover which block had what name. The same name-learning procedure as was used in Parts 1 and 3 was utilized here, and again a criterion of five successive correct identifications of each block was employed. After *S* reached the criterion, he was asked, "If you could take one of these blocks home, which would you pick?"

The color name learned for each of the three "nonsense" blocks was varied from *S* to *S* in order to correct for possible preference for one of the blocks because of its shape. Thus, for example, of three subjects, all trained to prefer black ("shoe") by having been given differential reinforcement for the square block ("shoe") in Part 2, each learned to call a different "nonsense" block "black" in this test situation. Each of the three Ss was expected to choose that block which he had learned to call "black."

Group IV. The *E* told Ss in this group a story about a pair of twins who had just moved into a new neighborhood. During the course of the story the twins meet three groups of children, a green, a yellow, and a black group. The play activities described for the three groups are almost identical. The climax of the story is reached when the twins decide to have a birthday party and their parents insist that they can invite only *one* of the groups of their new friends. The twins must choose only one of the groups for their party. Each *S* was asked by *E* to choose the group he would invite. A correct choice was picking that group having the same color as the rectangular block which S had learned, in Part 3, had the same name as the geometrical block under which he had consistently found marbles in Part 2.

RESULTS

Table 1 summarizes the generalization results obtained from *Ss*' responses in their respective test situations. The numbers in parentheses represent expected frequencies. It was expected that since each *S* had to choose among three colors or three colored objects in the test situation, one third of the group could choose the correct (i.e., trained for) color and two thirds of the group could choose the incorrect color by chance alone. A significant deviation from these proportions in the direction of more than one third Yeses and less than two thirds *Noes* refutes the null hypothesis and lends support to the experimental hypothesis.

It can be seen from Table 1 that the performance of all groups verified the experimental hypothesis. The null hypothesis of no significant difference between obtained and theoretical frequencies can be safely rejected, and the training given each group is thus shown to be adequate for the generalization of a positive choice response from one stimulus to a previously neutral one.

A chi-square test of independence was also run on the data shown in Table 1 to see if there were any significant differences among the four groups in the success-failure ratio. No such differences were found ($\chi^2 = 3.0$; $p > .30$). A test between Groups I and II combined and Groups III and IV combined also yielded insignificant results, although there is an indication that the more difficult task re-

TABLE 1

Generalization Results: Responses of Subjects in All Groups in Their Respective Test Situations

GROUP	*N*	NO. OF *Ss* MAKING CORRECT CHOICE	NO. OF *Ss* MAKING INCORRECT CHOICE	χ^2	p^*
I	9	8 (3)	1 (6)		<.002**
II	18	14 (6)	4 (12)	16.00	<.001
III	27	16 (9)	11 (18)	8.17	<.01
IV	27	17 (9)	10 (18)	10.67	<.01

* Probability that the difference between obtained and expected frequencies could have occurred by chance alone.

** Since the theoretical frequencies and total *N* of Group I are too low for the reliable use of χ^2, the probability figure shown was obtained by evaluating the data by means of the binomial expansion (both tails of the distribution considered).

From Eisman: Attitude formation: The development of a color preference response through mediated generalization.

quired of Ss in these latter two groups served to lower the number of correct responses ($\chi^2 = 3.37; p > .05$).[2]

GENERAL DISCUSSION AND CONCLUSIONS

The results of this experiment have shown that conditions which allow for mediated generalization, and which, in certain cases, offer Ss additional opportunities for reward and "labeling" experience, are sufficient to produce a positive response toward a previously neutral color with which Ss had had no differential reward experience. From this positive response, a favorable "attitude" towards this color is inferred. In addition, this favorable attitude has been demonstrated in more than one type of situation.

Space limitations do not permit a full presentation of the analysis of the results of this study in terms of learning theory concepts and principles. One illustration of the kind of analysis performed will have to suffice.

Figure 1 represents the conditions for and results of training for Ss in Group IV. Stage A represents Parts 1 and 3 of the experimental training, i.e., the name-learning sessions; Stage B represents Part 2, the reward session; and Stage C represents Part 5, the test situation. Stage A might have been better represented by three diagrams—one for each geometrical block and colored rectangle pair to which S learned to give the same name. For convenience, only one diagram, however, is used to represent all three. In stage B only one S_g is referred to, depending upon which geometrical block a particular S was consistently rewarded for choosing.

In stage C, the test situation, color names of three groups of children in a story were presented as oral stimuli to the Ss by *E*. S_{cn} represents these color-name stimuli. Each of the color-name stimuli can evoke a specific r_n-s_n because of the relationship shown in Fig. 1 under the heading "conditioning assumed to have occurred prior to the experiment." It is assumed that the Ss, outside the experimental situation, have learned to make this same response to both S_c (a visual color stimulus) and S_{cn} (an auditory color stimulus, i.e., a color name). This same response is R_{cn} (naming the color, for example, "yellow"). If we now invoke the principle of mediated generalization we can say that any response subsequently conditoned to S_c will also be evocable by S_{cn}. In stage A such a new response was conditioned to S_c, namely the "egg," "car," or "shoe" response, R_n. As a result, when S_{cn} is presented in stage C, it can evoke the implicit and anticipatory component of R_n, namely r_n-s_n.

Once we have thus accounted for the evocation of r_n-s_n, we can see how this can evoke the anticipatory component of R_{ch}, namely r_{ch}-s_{ch}, the "attitude." This stems from the conditioning which took place in stage B and from the anticipatory nature of r_{ch}-s_{ch}. In this situation we see that r_{ch}-s_{ch} evokes, not the old R_{ch} of stage B, but a slightly different choice response ($R_{ch'}$). Both choice responses can be understood as being part of a habit family

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[2] The influence of age and sex on generalization in this experimental situation was tested by means of chi square. No significant differences were found to exist between Ss above and below the median age of their respective groups with respect to success and failure on the generalization tests. Similarly, no significant difference in the success-failure ratio was found to hold between the sexes.

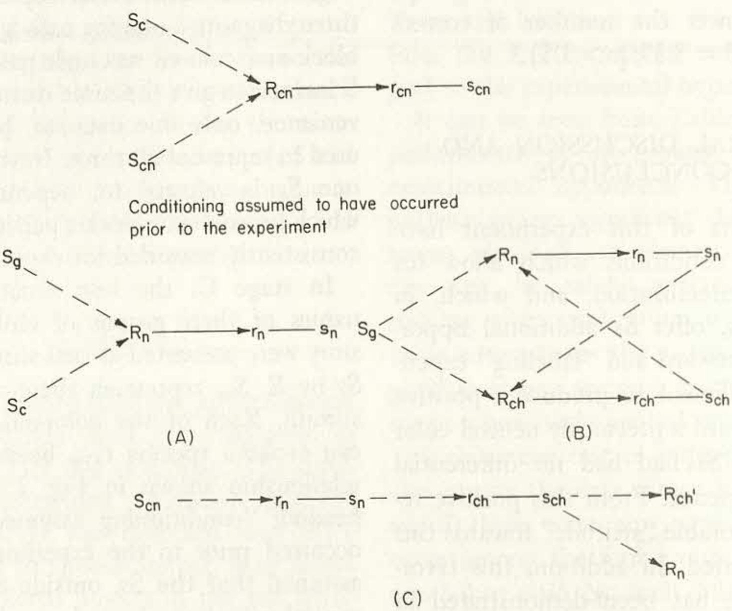

FIG. 1. Conditions for and results of training for Ss in group IV. *S* stands for stimulus of either geometric blocks (g) or colors (c); *R* stands for overt responses of either naming (n) or choosing (ch); *r* stands for implicit responses and *s* stands for stimuli produced by these implicit responses. From Eisman: Attitude formation: The development of a color preference response through mediated generalization.

associated with the same stimulus, r_{ch}-s_{ch}, the "attitude." The evocation of the correct choice response, $R_{ch'}$, cannot be fully explained without assuming, as we have done, its evocation by its implicit component, the attitudinal response-produced stimulus r_{ch}-s_{ch}.

There is one part of our diagram which has thus far been ignored. We have said that in stage *B* r_n-s_n becomes conditioned to R_{ch} and that similarly r_{ch}-s_{ch} becomes conditioned to R_n. That this is indeed the case was demonstrated by the fact that many Ss, when choosing the colored group of their choice also used an "egg," "car," or "shoe" name to refer to it. Stage C, therefore, has been diagrammed to include the evocation of R_n by r_{ch}-s_{ch}.

Analyses of the conditions and results of training for Ss in Groups I, II, and III involve the application of similar principles.

It is hoped that the present study represents a step in the direction of experimentally validating certain principles of learning theory on a human level in more or less uniquely human situations. The author has shown that at least one of these principles (mediated generalization) can be used to predict a certain type of human behavior, preference for a class of stimuli with which individuals have had only neutral experience. This type of behavior is common and shows itself most dramatically in the exhibition of attitudes toward social or ethnic groups with which individuals have had little or no direct experience. That such attitudes may be directly taught by parents or other "teachers" and maintained by group reinforcement is one possibility. That they may also be formed in the indirect manner experimentally demonstrated by this study is another. It is not too big a step to assume that if children can learn to prefer the color yellow, for example, over the colors green and black as a result of the type of training given them in this investigation, they can also, as a result of similar training, learn to prefer people called Englishmen over those called Poles and Italians, even though they have had no differential reward or punishment experience with any of those three national groups. The essential requirement for this learning is that individuals should learn to attach the same labels to the word "Englishman" as to stimuli with which they have rewarding experience, and to attach the same labels to the words "Pole" or "Italian" as to stimuli with which they have had neutral or punishing experience.

SUMMARY

Eighty-one elementary school children of grades 1, 2, and 3 were trained to label a white triangular block and a green rectangular block "egg," to label a white square block and a black rectangular block "shoe," and to label a white circular block and a yellow rectangular block "car." In a subsequent situation all Ss were rewarded for choosing one particular geometrical white block. The Ss in Group I were then tested for mediated generalization by being asked to choose which of the colored rectangles they thought would bring a reward. The Ss in Group II were presented with three new, i.e., previously unexperienced, color stimuli and asked to guess which one would bring a reward. The Ss in Group III learned to label three different white "nonsense" blocks "yellow," "black," and "green," respectively, and then were asked to choose the block they would like to take home. The Ss in Group IV were told a story about three groups of children, a yellow, a black, and a green group, and then asked which group they would invite to a hypothetical birthday party.

For each group it was predicted that Ss would choose that stimulus in the test having the same actual color or color name as the colored rectangle which they had learned had the same "egg," "car," or "shoe" name as the geometrical block for the choice of which they had previously been rewarded. These predictions were verified. Significantly more Ss in each group made the correct choices in the test than would have been expected by chance.

The investigation was designed to test the general hypothesis that a color-preference response (positive attitude) could be developed through mediated generalization, and that this preference could be demonstrated in four situations differing in context, complexity, and social significance. An analysis, in terms of reinforcement learning theory principles and concepts, of the experimental conditions and results for Group IV was presented as illustrative of the type of analysis necessary for a full explanation of the behavior of Ss of all four groups in their respective test situations.

REFERENCES

1. Allport, G. W. Attitudes. In C. Murchison (Ed.), *A handbook of social psychology*. Worcester, Mass.: Clark Univer. Press, 1935. Pp. 798–844.
2. Birge, Jane S. The role of verbal responses in transfer. Unpublished doctor's dissertation, Yale Univer., 1941.

3. Cofer, C. N., & Foley, J. P., Jr. Mediated generalization and the interpretation of verbal behavior: I. Prolegomena. *Psychol. Rev.*, 1942, **49,** 513–540.
4. Cofer, C. N., & Foley, J. P., Jr. Mediated generalization and the interpretation of verbal behavior: II. Experimental study of certain homophone and synonym gradients. *J. exp. Psychol.*, 1943, **32,** 168–175.
5. Cofer, C. N., Janis, Marjorie G., & Rowell, Mary M. Mediated generalization and the interpretation of verbal behavior: III. Experimental study of antonym gradients. *J. exp. Psychol.*, 1943, **32,** 266–269.
6. Dollard, J., & Miller, N. E. *Personality and psychotherapy*. New York: McGraw-Hill, 1950.
7. Doob, L. W. The behavior of attitudes. *Psychol. Rev.*, 1947, **54,** 135–156.
8. Foley, J. P., Jr., & Mathews, M. A. Mediated generalization and the interpretation of verbal behavior: IV. Experimental study of the development of interlinguistic synonym gradients. *J. exp. Psychol.*, 1943, **33,** 188–200.
9. Foley, J. P., Jr., & MacMillan, Z. L. Mediated generalization and the interpretation of verbal behavior. V. Free association as related to differences in professional training. *J. exp. Psychol.*, 1943, **33,** 299–310.
10. Hull, C. L. Knowledge and purpose as habit mechanisms. *Psychol. Rev.*, 1930, **6,** 511–525.
11. Keller, Margaret. Mediated generalization: the generalization of a conditioned GSR established to a pictured object. *Amer. J. Psychol.*, 1943, **56,** 438–448.
12. Krech, D., & Crutchfield, R. S. *Theories and problems of social psychology*. New York: McGraw-Hill, 1948.
13. Razran, G. H. S. Salivating and thinking in different languages. *J. Psychol.*, 1935–36, **1,** 145–151.
14. Razran, G. H. S. A quantitative study of meaning by a conditioned salivary technique (semantic conditioning). *Science*, 1939, **90,** 89–90.
15. Riess, B. F. Semantic conditioning involving the GSR. *J. exp. Psychol.*, 1940, **26,** 238–240.
16. Riess, B. F. Genetic changes in semantic conditioning. *J. exp. Psychol.*, 1946, **36,** 143–152.
17. Sherif, M., & Cantril, H. The psychology of attitudes. *Psychol. Rev.*, 1945, **52,** 293–319.

30.

Attitude Change through Reward of Verbal Behavior*[1]

William A. Scott

Public opinion researchers are familiar, through anecdote if not personal ac-

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* From W. A. Scott, Attitude change through reward of verbal behavior, *J. abnorm. soc. Psychol.*, **55,** 72–75 (1957). Reprinted by permission of the author and the American Psychological Association.

[1] The author is indebted to Prof. Maurice P. Smith for his suggestions regarding design and report of the study, and to the following graduate teaching fellows who assisted in the collection of data: H. Hess, P. Khanna, A. Mathews, and I. Richardson.

quaintance, with the woman who, when asked her opinion on social security, replied that she didn't know because no one had ever asked her, and she never knew what her opinions were until she opened her mouth and expressed them. Perhaps this apocryphal respondent was displaying more insight into the psychological processes underlying her attitude than is readily apparent. Though cognitive approaches to attitude development are more flattering in their emphasis on the rationally cognized relation of an object to the person's goals (1, 3, 8, 9), nonrational determiners may be equally important in the acquisition of attitudes.

According to Doob (4) an attitude may be regarded, like a habit, as an implicit anticipatory response which mediates overt behaviors, and arises out of them through response reinforcement. Thus, it is conceivable that an opinion be expressed initially, in the absence of a supporting attitude, but if the verbal behavior is rewarded, the corresponding attitude may develop and mediate subsequent opinion expressions in the presence of similar cues. This response reinforcement formulation thus focuses more on reward of verbal expressions than on cognized means-end relationships as critical factors in attitude development.

The two formulations, and the sets of variables they employ, are by no means incompatible. It is reasonable to suggest, for instance, that lacking a well structured and salient set of cognitive associations regarding an object, a person may be more readily induced to respond to it in nonlogical fashion, the outcome of his response then contributing to a nascent cognitive structure; but given a set of values and cognitions that can readily be applied to a new object, these will influence the person's attitudinal set and thus produce a response consistent with the pre-existing cognitive structure. It is not the purpose of this paper to propose a systematically inclusive formulation of these two classes of determinants, but rather to offer evidence concerning the efficacy of response reinforcement in the determination of attitudes.

Other studies (2, 5, 10) have demonstrated the influence of social approval and disapproval on the modification of verbal behavior, but they provide no information about their effects on the underlying attitudes. The present study was designed to explore, in a controlled fashion, the effects on attitudes of reward and punishment of expressed opinions. Specifically, it was predicted that subjects (*Ss*) rewarded by group approval for expressing opinions opposite from their initial attitudes would show a change in the direction of the expressed opinions, while Ss punished by group disapproval for expressing contrary opinions would not show such a change. This prediction implies that reward of a new behavior increases the relative strength of the underlying predisposition, while punishment of a new behavior leads the *S* to revert to his formerly preferred response disposition.

Method

All students in 29 general psychology discussion sections were administered free-response questions on mimeographed sheets to assess their attitudes toward three controversial issues:

1. *Universal military training.* It has been proposed that all physically able males between the ages of 18 and 25 be required to spend two years in the armed forces so that they will be trained and ready for armed service in the event

of a national emergency. How do you feel about this proposal?

2. *Night hours for women students.* Senior women at the University are not required to be back in their dorms or houses by any set time at night. Some students are requesting that all women be given the same freedom of hours. How do you feel about this?

3. *De-emphasis of football.* It has been suggested that too much emphasis is placed on football at the University, in scholarships and special treatment for players. How do you feel about this?

Each of the classes was assigned, in systematic fashion, one of the three issues for debate. The instructor read the class members' opinions on the designated issue and selected from each class two which appeared definitely favorable and two definitely unfavorable. The four students were contacted outside of class and their cooperation requested in an "experiment to see how much they could affect the opinions of class members" by debating the particular issue; but each student would take the side opposite to his own opinion. Two pairs of debators were formed for each class, members with "pro" opinions taking the "con" side of the argument, and vice versa. It was explained that, following the debate, the quality of performance would be assessed in two ways: first, by a class vote on which member of each pair did the better job; and second, by a retest of the class' opinions on the issue, "to see in which direction opinions are influenced."

The debators were counseled to avoid mentioning to anyone that they didn't really believe what they were to say. (This was intended to help prevent the occurrence of interfering responses (see 7) which might negate the effect of the experimental stimulus.) In pairing the debators, an attempt was made to equate their verbal abilities, as evidenced in their written opinions, in order that a subsequent false report of the vote would appear valid.

The debates were held two weeks after the original assessment of attitudes. One pair of opponents was called into the classroom, while the other pair waited in an adjoining room. The "pro" debator spoke first, for three minutes, followed by a three-minute presentation from the "con" debator. Then each had a two-minute rebuttal period, in reverse order. The first pair left the room, and the second pair of opponents entered for a similar performance. Then, with all four debators present, voting instructions were given to the class ("On the first ballot write which side—pro or con—did a better job on the first debate. On the second ballot write which side—pro or con—did a better job on the second debate").

The ballots were handed in, and the instructor made a pretense of counting them, while one of the students tallied votes (as read by the instructor) on the blackboard, under the name of each debator. It had been determined in advance for each pair of debators in all classes who would "win." "Winners" and "losers" were assigned alternately through the pairs of debators, so that half the time the "pros" won, and half the time the "cons" won.

The instructor then repeated the implications of the vote, mentioning the names of the "winners" and "losers," and explained that the next step in the judgment would be to see how the class's attitudes had been affected. All class members were given sheets of paper on which were printed the statement of the issue that had been debated—exactly like the first opinion assessment, except that only one issue appeared on the sheet. Debators were also asked to write their present opinions, "to see if there was any change in them."

After the opinion retest forms were collected, the nature and purpose of the experiment were explained, the pre- and postopinions of the debators were read, and an attempt made to reduce the threat of the situation for the "losers" and for those debators whose opinions had ostensibly shifted.

The pre- and postopinions of the debators were subsequently typed on cards, after the deletion of certain passages that might indicate which were postopinions (such as "I still feel that . . ."). The cards were identified only by numbers, duplicated on the original opinion questionnaires, and the numbers assigned in "random" fashion, so as to prevent contamination in coding. Opinions on the cards were coded on a seven-point scale: 1—very pro; 2—pro; 3—pro, qualified; 4—neutral or balanced pro and con; 5—con, qualified; 6—con; 7—very con. Then, by reference to the original questionnaires, each card was identified as a pre- or postopinion of a "winner" or "loser."

Of the 58 pairs of debators initially designated, only 36 finally produced complete data. Twenty-one pairs failed to debate, due either to absences or to rescheduling of classes; the postopinion of one member of the final pair was not codeable. The 36 debates took place in 19 different classes, with six different instructors. From these classes a sample of 36 students whose original opinions were definitely pro or con, but who did not debate, was selected as a control group. Their pre- and postopinions were similarly transferred to cards with random identification by numbers, and coded on the same seven-point scale.

Results

It was predicted that debators who "won" would show an average change in the direction of their debate greater than the corresponding change shown by "losers" and greater than the average change of the control group. Data bearing on this prediction are presented in Table 1. Winners changed an average of 1.25 points (in the direction of debate) on the seven-point scale, while losers changed an average of 0.17 points in the opposite direction (more extreme than their original positions). The control group changed an average of 0.31 points toward the opinion opposite from their original one.

The difference between mean changes of winners and losers is significant beyond the .001 level of confidence, and the difference between winners and controls is significant beyond the .02 level of confidence. The difference between losers and controls is not significant.

An analysis of mean changes for the three issues separately, and for original pros versus original cons showed no significant differences among these groups, so the prediction was confirmed regardless of the issue and regardless of which extreme opinion the debator started with. When the *proportions of changers* in the three groups are compared, results are consistent with those for mean changes. More winning individuals shifted toward the opposite opinion than either losers or controls.

DISCUSSION

The experiment was designed to give both winners and losers equivalent contact with arguments for the opposite side, and to give both the experience of verbal-

TABLE 1

Changes of Winners, Losers and Controls from Pre- to Post-test
(Positive sign indicates mean change in direction opposite to Ss' original opinions)

	WINNERS ($N = 36$)	LOSERS ($N = 36$)	CONTROLS ($N = 36$)
Number of changers (either direction)	24	16	18
Number of changers (toward opp. direction)	21	7	11
Mean change	+1.25	−0.17	+0.31
SD of change	1.77	1.17	1.37

Difference in mean changes:
Winners *vs.* losers: $t = 3.97$; $p < .001$.
Winners *vs.* controls: $t = 2.49$; $p < .02$.
Losers *vs.* controls: $t = -1.58$; $p > .10$.

From Scott: Attitude change through reward of verbal behavior.

izing these arguments as if they were their own. What distinguished the two groups was the brief experience of either group approval or group disapproval for their performances. These performances involved principally the oral presentation of arguments—verbal behavior to which they were unaccustomed. The vote of "win" is presumed to have reinforced the verbal behavior and with it the accompanying implicit responses—attitudes and cognitive support for them. The vote of "lose" presumably weakened whatever response tendencies had been established by the overt behavior or by cognitive contact with the opposite side, so that Ss reverted to their pre-existing attitudes.

If the opinion posttests be regarded as valid reflections of Ss' attitudes following the experimental stimulus, then one may conclude that social reward for expressing a new opinion tends to reinforce the concomitant attitudes, whereas social disapproval of the new behavior tends to lead to nonreinforcement of the accompanying attitudes. It appears that, in the present experiment, the brief experience of reward or punishment was a significant factor in accounting for attitude change, rather than the more prolonged experience of cognitive contact with opposing arguments.

This finding is, however, subject to at least two interpretations. It may be that reward of a new behavior was the crucial factor, while cognitive contact in and of itself had no effect. Or it may be that contact with opposing arguments produced a change in attitude, which was then reinforced or extinguished depending on whether the first overt expressions were rewarded or punished. Since Janis and King (6) showed that contact with the opposite side tended, by itself, to produce some change, the latter interpretation appears more plausible. In order to help determine the relative importance of these two influences—cognitive contact and reinforcement—in this situation, it would have been necessary to have some

Ss debate without a subsequent "winning" or "losing" experience. This experiment did not provide for such a condition. Regardless of whether one accepts a single-factor or a two-factor interpretation of the results, it appears that they speak clearly for the significance of reward in producing attitude change in this type of situation.

It should be noted that very few of the changes in opinion were of a spectacular sort. (Only seven of the rewarded Ss reversed the direction of their opinions; the other fourteen changers merely showed some weakening of their initial opinions, as indicated by a shift along the seven-point scale toward the neutral position.) Although the experience of success or failure was made as strong as possible under these restricted conditions, it was nevertheless a brief and perhaps not too potent one. Between the announcement of the "class vote" and the posttest of opinion no more than five minutes elapsed.

The degree to which the new opinions persisted was not assessed in this study. It is reasonable to suppose that effects of the experimental situation were transitory, since the Ss' initial attitudes presumably found considerable social support in their current friendship groups. In order to produce enduring attitude changes, it would probably be necessary to so change the Ss' social environments that the new behaviors would receive continued reinforcement. But transitory or enduring, the principles of attitude change illustrated in this experiment would appear to be applicable.

SUMMARY

An experiment in attitude change was suggested by Doob's learning theory of attitude development. Seventy-two Ss were induced to engage in debates on three different issues, taking sides opposite to those which they had indicated as their own in an opinion pretest. Half of the Ss were rewarded, in predetermined order, by a purported vote which proclaimed them the better debators, while the other half were punished by presumably losing the debate. Posttests of Ss' opinions showed a tendency of the "winners" to change their opinions in the direction of their debates, while the "losers" did not change significantly. A control group of nondebators likewise showed no significant change in opinions.

REFERENCES

1. Carlson, E. Attitude change through modification of attitude structure. *J. abnorm. soc. Psychol.*, 1956, **52,** 256–261.
2. Cohen, B. D. *et al.* Experimental manipulation of verbal behavior. *J. exp. Psychol.*, 1954, **47,** 106–110.
3. Crockett, W. H. Attitude change as a function of cognitive differentiation and affect under conditions of norm-presentation with and without counter-arguments. Unpublished doctor's dissertation, Univer. of Michigan, 1952.
4. Doob, L. W. The behavior of attitudes. *Psychol. Rev.*, 1947, **54,** 135–156.
5. Hildrum, D. C., & Brown, R. W. Verbal reinforcement and interviewer bias. *J. abnorm. soc. Psychol.*, 1956, **53,** 108–111.
6. Janis, I. L., & King, B. T. The influence of role playing on opinion change. *J. abnorm. soc. Psychol.*, 1954, **49,** 211–218.
7. Kelman, H. C. Attitude change as a function of response restriction. *Hum. Rel.*, 1953, **6,** 185–214.
8. Krech, D., & Crutchfield, R. S. *Theory and problems of social psychology.* New York: McGraw-Hill, 1948. Chaps. 5–6.

9. Rosenberg, M. J. Cognitive structure and attitudinal affect. *J. abnorm. soc. Psychol.*, 1956, **53,** 367–372.
10. Verplanck, W. S. The control of the content of conversation: reinforcement of statements of opinion. *J. abnorm. soc. Psychol.*, 1955, **51,** 668–676.

31.

Attitudes Established by Classical Conditioning*[1]

Arthur W. Staats and

Carolyn K. Staats

Osgood and Tannenbaum have stated, ". . . The *meaning* of a concept is its location in a space defined by some number of factors or dimensions, and *attitude* toward a concept is its projection onto one of these dimensions defined as 'evaluative'" (9, p. 42). Thus, attitudes evoked by concepts are considered part of the total meaning of the concepts.

A number of psychologists, such as Cofer and Foley (1), Mowrer (5), and Osgood (6, 7), to mention a few, view meaning as a response—an implicit response with cue functions which may mediate other responses. A very similar analysis has been made of the concept of attitudes by Doob, who states, "'*An attitude is an implicit response . . . which is considered socially significant in the individual's society*'" (2, p. 144). Doob further emphasizes the learned character of attitudes and states, "The learning process, therefore, is crucial to an understanding of the behavior of attitudes" (2, p. 138). If attitudes are to be considered responses, then the learning process should be the same as for other responses. As an example, the principles of classical conditioning should apply to attitudes.

The present authors (12), in three experiments, recently conditioned the evaluative, potency, and activity components of word meaning found by Osgood and Suci (8) to contiguously presented nonsense syllables. The results supported the conception that meaning is a response and, further, indicated that word meaning is composed of components which can be separately conditioned.

The present study extends the original experiments by studying the formation of attitudes (evaluative meaning) to socially significant verbal stimuli through classical conditioning. The socially significant verbal stimuli were national names and familiar masculine names. Both of these types of stimuli, unlike nonsense syllables, would be expected to evoke attitudinal responses on the basis of the pre-experimental experience of the Ss. Thus, the purpose of the present study is to test the hypothesis that attitudes already elicited by socially significant verbal stimuli can be changed through classical conditioning, using other words as unconditioned stimuli.

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*From A. W. Staats and C. K. Staats, Attitudes established by classical conditioning, *J. abnorm. soc. Psychol.*, **57,** 37–40 (1958). Reprinted by permission of the authors and the American Psychological Association.

[1] This article is part of a series of studies of language learning formulated by the first author as the principal investigator of a research project supported by the Office of Naval Research under Contract NONR-2305 (00) with Arizona State College at Tempe.

Method

Subjects

Ninety-three students in elementary psychology participated in the experiments as Ss to fulfill a course requirement.

Procedure

The general procedure employed was the same as in the previous study of the authors (12).

Experiment I

The procedures were administered to the Ss in groups. There were two groups with one half of the Ss in each group. Two types of stimuli were used: national names which were presented by slide projection on a screen (*CS* words) and words which were presented orally by the *E* (*US* words), with Ss required to repeat the word aloud immediately after *E* had pronounced it. Ostensibly, Ss' task was to separately learn the verbal stimuli simultaneously presented in the two different ways.

Two tasks were first presented to train the Ss in the procedure and to orient them properly for the phase of the experiment where the hypotheses were tested. The first task was to learn five visually presented national names, each shown four times, in random order. Ss' learning was tested by recall. The second task was to learn 33 auditorily presented words. Ss repeated each word aloud after *E*. Ss were tested by presenting 12 pairs of words. One of each pair was a word that had just been presented, and Ss were to recognize which one.

The Ss were then told that the primary purpose of the experiment was to study "how both of these types of learning take place together—the effect that one has upon the other, and so on." Six new national names were used for visual presentation: *German, Swedish, Italian, French, Dutch,* and *Greek* served as the *CS*s.

These names were presented in random order, with exposures of five sec. Approximately one sec. after the *CS* name appeared on the screen, *E* pronounced the *US* word with which it was paired. The intervals between exposures were less than one sec. Ss were told they could learn the visually presented names by just looking at them but that they should simultaneously concentrate on pronouncing the auditorily presented words aloud and to themselves, since there would be many of these words, each presented only once.

The names were each visually presented 18 times in random order, though never more than twice in succession, so that no systematic associations were formed between them. On each presentation, the *CS* name was paired with a different auditorily presented word, i.e., there were 18 conditioning trials. *CS* names were never paired with *US* words more than once so that stable associations were not formed between them. Thus, 108 different *US* words were used. The *CS* names, *Swedish* and *Dutch*, were always paired with *US* words with evaluative meaning.

The other four *CS* names were paired with words which had no systematic meaning, e.g., chair, with, twelve. For Group 1, *Dutch* was paired with different words which had positive evaluative meaning, e.g., gift, sacred, happy; and *Swedish* was paired with words which had negative evaluative meaning, e.g., bitter, ugly, failure.[2] For Group 2, the order of *Dutch* and *Swedish* was reversed so that *Dutch* was paired with words with negative evaluative meaning and *Swedish* with positive meaning words.

When the conditioning phase was completed, *S*s were told that *E* first wished to find out how many of the visually presented words they remembered. At the same time, they were told, it would be necessary to find out how they *felt* about the words since that might have affected how the words were learned. Each *S* was given a small booklet in which there were six pages. On each page was printed one of the six names and a semantic differential scale. The scale was the seven-point scale of Osgood and Suci (8), with the continuum from pleasant to unpleasant. An example is as follows:

German
pleasant:___:___:___:___:___:___:___:unpleasant

The *S*s were told how to mark the scale and to indicate at the bottom of the page whether or not the word was one that had been presented.

The *S*s were then tested on the auditorily presented words. Finally, they were asked to write down anything they had thought about the experiment, especially the purpose of it, and so on, or anything they had thought of during the experiment. It was explained that this might have affected the way they had learned.

Experiment II

The procedure was exactly repeated with another group of *S*s except for the *CS* names. The names used were *Harry*, *Tom*, *Jim*, *Ralph*, *Bill*, and *Bob*. Again, half of the *S*s were in Group 1 and half in Group 2. For Group 1, *Tom* was paired with positive evaluative words and *Bill* with negative words. For Group 2 this was reversed. The semantic differential booklet was also the same except for the *CS* names.

Design

The data for the two experiments were treated in the same manner. Three variables were involved in the design: conditioned meaning (pleasant and unpleasant); *CS* names (*Dutch* and *Swedish*, or *Tom* and *Bill*); and groups (1 and 2). The scores on the semantic differential given to each of the two *CS* words were analyzed in a 2 x 2 latin square as described by Lindquist (4, p. 278) for his Type II design.

Results

The 17 *S*s who indicated they were aware of either of the systematic name-word relationships were excluded from the analysis. This was done to prevent the interpretation that the conditioning of attitudes depended upon awareness. In order to maintain a counter-balanced design when these Ss were excluded, four Ss were randomly eliminated from the analysis. The resulting *N*s were as follows: 24 in Experiment I and 48 in Experiment II.

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[2] The complete list of *CS-US* word pairs is not presented here, but it has been deposited with the American Documentation Institute. Order Document No. 5463 from ADI Auxiliary Publications Project, Photoduplication Service, Library of Congress, Washington 25, D.C., remitting in advance $1.25 for microfilm or $1.25 for photocopies. Make checks payable to Chief, Photoduplication Service, Library of Congress.

Table 1 presents the means and *SD*s of the meaning scores for Experiments I and II. The table itself is a representation of the 2 × 2 design for each experiment. The pleasant extreme of the evaluative scale was scored 1, the unpleasant 7.

The analysis of the data for both experiments is presented in Table 2. The results of the analysis indicate that the conditioning occurred in both cases. In Experiment

TABLE 1

Means and SDs of Conditioned Attitude Scores

		NAMES			
		Dutch		*Swedish*	
Experiment	Group	Mean	*SD*	Mean	*SD*
I	1	2.67	.94	3.42	1.50
	2	2.67	1.31	1.83	.90
		Tom		*Bill*	
Experiment	Group	Mean	*SD*	Mean	*SD*
II	1	2.71	2.01	4.12	2.04
	2	3.42	2.55	1.79	1.07

Note. On the scales, pleasant is 1, unpleasant 7.

From Staats and Staats: Attitudes established by classical conditioning.

TABLE 2

Summary of the Results of the Analysis of Variance for Each Experiment

	EXP. I			EXP. II		
Source	*df*	MS	*F*	*df*	MS	*F*
Between *S*s						
groups	1	7.52	4.36*	1	15.84	5.00*
error	22	1.73		46	3.17	
Within						
conditioned attitude	1	7.52	5.52*	1	55.51	10.47**
names	1	.02	.01	1	.26	.05
residual	22	1.36		46	5.30	
Total	47			95		

* $p < .05$.

$p < .01$.

From Staats and Staats: Attitudes established by classical conditioning.

I, the *F* for the conditioned attitudes was significant at better than the .05 level. In Experiment II, the *F* for the conditioned attitudes was significant at better than the .01 level. In both experiments the *F* for the groups variable was significant at the .05 level.

DISCUSSION

It was possible to condition the attitude component of the total meaning responses of *US* words to socially significant verbal stimuli, without *Ss'* awareness. This conception is schematized in Fig. 1, and in so doing, the way the conditioning in this study was thought to have taken place is shown more specifically. The national name *Dutch*, in this example, is presented prior to the word *pretty*. *Pretty* elicits a meaning response. This is schematized in the figure as two component responses; an evaluative response r_{PV} (in this example, the words have a positive value), and the other distinctive responses that characterize the meaning of the word, R_P. The pairing of *Dutch* and *pretty* results in associations between *Dutch* and r_{PV}, and *Dutch* and R_P. In the following presentations of *Dutch* and the words *sweet* and *healthy*, the association between *Dutch* and r_{PV} is further strengthened. This is not the case with associations R_P, R_S, and R_H since they occur only once and are followed by other associations which are inhibitory. The direct associations indicated in the figure between the name and the individual words would also in this way be inhibited.

It was not thought that a rating response was conditioned in this procedure but rather an implicit attitudinal response which mediated the behavior of scoring the semantic differential scale. It is possible, with this conception, to interpret two studies by Razran (10, 11) which concern the conditioning of ratings. Razran found that ratings of ethnically labeled pictures of girls and sociopolitical slogans could be changed by showing these stimuli while *Ss* were consuming a free lunch and, in

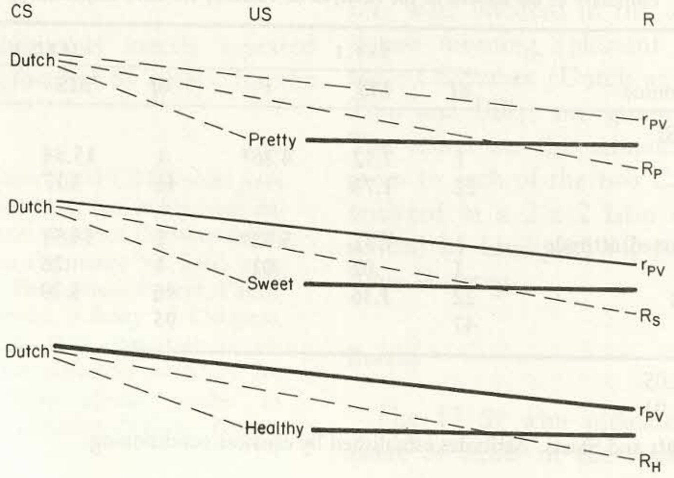

FIG. 1. The conditioning of a positive attitude. The heaviness of line represents strength of association. From Staats and Staats: Attitudes established by classical conditioning.

the case of the slogans, while the Ss were presented with unpleasant olfactory stimulation. The change in ratings could be thought to be due to the conditioning of an implicit evaluative response, an attitude, to the CSs by means of the lunch or the unpleasant odors. That is, part of the total response elicited by the food, for example, was conditioned to the pictures or slogans and became the mediation process which in turn elicited the positive rating.

It should be stated that the results of the present study do not show directly that Ss' behavior to the object (e.g., a person of Dutch nationality) has been changed. The results pertain to the Ss' attitudinal response to the signs, the national names themselves. However, Kapustnik (3) has demonstrated that a response generalized to an object when the response had previously been conditioned to the verbal sign of the object. Osgood states,

> The aggressive reactions associated with *Nazi* and *Jap* on a verbal level certainly transferred to the social objects represented under appropriate conditions. Similarly, prejudicial behaviors established while reading about a member of a social class can transfer to the class as a whole . . . (7, p. 704).

The results of this study have special relevance for an understanding of attitude formation and change by means of verbal communication. Using a conception of meaning as a mediating response, Mowrer (5) has suggested that a sentence is a conditioning device and that communication takes place when the meaning response which has been elicited by the predicate is conditioned to the subject of the sentence. The results of the present study and the previous one of the present authors (12) substantiate Mowrer's approach by substantiating the basic theory that word meaning will indeed condition to contiguously presented verbal stimuli. In the present study, the meaning component was evaluative, or attitudinal, and the CSs were socially significant verbal stimuli. The results suggest, therefore, that attitude formation or change through communication takes place according to these principles of conditioning. As an example, the sentence, "Dutch people are honest," would condition the positive attitude elicited by "honest" to "Dutch"—and presumably to any person called "Dutch." If, in an individual's history, many words eliciting a positive attitude were paired with "Dutch," then a very positive attitude toward this nationality would arise.

The reason for the group differences in each of the experiments is not clear. These differences could have arisen because there were actual differences in the Ss composing each group, or in some condition of the procedure occurring to one of the groups. Nothing the authors were aware of seem to indicate this as the explanation, and in the previous experiments of the authors (12) there were no group differences. Since in a 2 x 2 latin square the interactions are entirely confounded with the main effects, the group differences could also have arisen as a result of the interaction of the other two main effects (i.e., direction of conditioning and names).

SUMMARY

Two experiments were conducted to test the hypothesis that attitude responses elicited by a word can be conditioned to a contiguously presented socially signifi-

cant verbal stimulus. A name (e.g., *Dutch*) was presented 18 times, each time paired with the auditory presentation of a different word. While these words were different, they all had an identical evaluative meaning component. In Experiment I, one national name was paired with positive evaluative meaning and another was paired with negative evaluative meaning. In Experiment II, familiar masculine names were used. In each experiment there was significant evidence that meaning responses had been conditioned to the names without Ss' awareness.

REFERENCES

1. Cofer, C. N., & Foley, J. P. Mediated generalization and the interpretation of verbal behavior: I. Prologemena. *Psychol. Rev.*, 1942, **49,** 513–540.
2. Doob, L. W. The behavior of attitudes. *Psychol. Rev.*, 1947, **54,** 135–156.
3. Kapustnik, O. P. The interrelation between direct conditioned stimuli and their verbal symbols. (Trans. from Russian title) *Psychol. Abstr.*, 1934, **8,** No. 153.
4. Lindquist, E. F. *Design and analysis of experiments in psychology and education.* Boston: Houghton Mifflin, 1953.
5. Mowrer, O. H. The psychologist looks at language. *Amer. Psychologist,* 1954, **9,** 660–694.
6. Osgood, C. E. The nature and measurement of meaning. *Psychol. Bull.*, 1952, **49,** 197–237.
7. Osgood, C. E. *Method and theory in experimental psychology*. New York: Oxford Univer. Press, 1953.
8. Osgood, C. E., & Suci, G. J. Factor analysis of meaning. *J. exp. Psychol.*, 1955, **50,** 325–338.
9. Osgood, C. E., & Tannenbaum, P. H. The principle of congruity in the prediction of attitude change. *Psychol. Rev.*, 1955, **62,** 42–55.
10. Razran, G. H. S. Conditioning away social bias by the luncheon technique. *Psychol. Bull.*, 1938, **35,** 693.
11. Razran, G. H. S. Conditioned response changes in rating and appraising sociopolitical slogans. *Psychol. Bull.*, 1940, **37,** 481.
12. Staats, C. K., & Staats, A. W. Meaning established by classical conditioning. *J. exp. Psychol.*, 1957, **54,** 74–80.

chapter VII

Social Interaction, Attitude Function, Group Cohesiveness, and Social Power

THERE HAVE BEEN A NUMBER of learning analyses made of social interaction. Miller and Dollard (1941) suggested that imitation may be considered in terms of learning principles. Within the framework of operant conditioning principles Skinner (1957) has made an analysis of the interaction of speaker and listener in what could be considered a communication interaction. Keller and Schoenfeld (1950) have dealt similarly with such interactions. More recently, Adams and Romney have presented an analysis of authority in terms of operant conditioning principles, and this is the first article presented in this section. Although Adams and Romney's formulation is in the context of authority relations, this may be considered in a more general framework as the paradigm for face-to-face social interaction.

Abstracting from the formulation, social interaction can be considered in terms of the discriminative stimulus value (S^D value) which one individual has for another, as well as his reinforcing value (S^r [or CS^r] when conditioned, S^R [or UCS^r] when unconditioned). Because of our training, certain people, including their physical attributes and various accoutrements and environmental contexts, come to control certain of our behaviors. In addition, because of the reinforcers they manipulate contingent upon our behavior, people also shape our behaviors in the process of social interaction. We also do the same with respect to their behavior.

Adams and Romney elaborate this in its necessary detail. However, with this abstraction as the basis, a number of other studies in the field of social psychology may be considered. First, for example, the experiment by Sidowski, Wyckoff, and Tabory isolates the effect of reinforcement in a laboratory situation. It is found that when an individual controls positive and negative reinforcers which he may (unknowingly) deliver contingent upon another individual's behavior, and vice versa, there is a tendency for each to shape the other to deliver only positive reinforcers. It seems, and perhaps this conclusion has more general validity, that behavior which is aversive to others results in, or is likely to result in, reciprocal behavior which is aversive—and this tends, albeit not precisely, to reduce the aversive behavior in both parties. It would also be expected that the converse would be true. The later analyses will suggest mechanisms for this effect.

The study by Azrin and Lindsley indicates how the nature of the situation in terms of its reinforcers and the "rules" by which they are delivered, as discussed in the previous chapter, may determine the nature of social interaction of two children. The behaviors involved may be considered to be cooperative, that is, behaving in concordance and sharing reinforcers. When the "rule" is such that only when each child shares the reinforcers will either of them attain any reinforcement, sharing behavior results even when, because of the pre-experimental histories of the children, they do not commence the interaction by sharing.

The experiment by Cohen may be considered to demonstrate in a laboratory situation the different S^D effect that various people have for an individual with respect to leadership and following behavior. As Cohen points out, the effects of the other people on the individual's behavior is a result of the pre-experimental history of the individual with respect to those people—presumably, it might be added, the experience that would establish them as S^D's for the type of behavior studied. In addition, Cohen's results show the effects of the manipulation of reinforcement on the behavior. That is, although the individual's behavior on entering the experimental situation is a function of his past experience with respect to the various people with whom he interacts, the experimenter can change the nature of the interaction by manipulation of the reinforcement contingencies in the social situation.

At this juncture, another principle important to the understanding of human motivation and social interaction will be introduced. We have already discussed the fact that the nature of, and rules of application of, reinforcers are crucial in shaping human behavior. This is so because a reinforcer when it follows a behavior will increase the strength of the behavior or maintain it in good strength.

In addition, however, the importance of reinforcing stimuli, especially those of a social nature (attitudinal stimuli) may be seen when it is realized that establishing or changing the reinforcement value of a stimulus will change the power of that stimulus to *elicit* or *control* behavior. It is this function of stimuli that is frequently referred to in accounts of human motivation in the various social and behavioral sciences—and that has not been recognized fully in experimental psychology. Thus, it has been said that in addition to their rewarding value motivational stimulus objects also *direct* or *control* the behavior of striving for those objects. It is, in part, because such stimuli do control "striving" behavior of various kinds that human behavior has been called goal-directed. The observation that motivational stimuli elicit or control behavior can be accounted for within the laboratory-established principles of learning, as the following analysis will suggest. And two studies will be presented that support the analysis.

To begin, when a stimulus object is a reinforcer for a child, it is very likely to become an S^D that will control various responses whose result is obtaining the object. Let us say that the stimulus object is a reinforcer for the child but does not yet control any behavior. In this case, if the child makes responses that take him away from the object, he is not reinforced by obtaining the object. However, some responses, for example, crawling or creeping toward the object, will result in receiving the object, thus reinforcing that behavior in the presence of that stimulus object. This of course fits the principle for establishing a discriminative stimulus (S^D) that controls a response. That is, when a response is reinforced in the presence of a stimulus, the stimulus will come to bring on or control the behavior. (A stimulus that is a CS^r *and* an S^D can be called a $CS^{r\&D}$.)

All reinforcing stimulus objects have the power to reinforce responses that result in obtaining those objects, and thereby are likely to become S^Ds that control that type of behavior. Thus, in the child's experience a wide variety of stimulus objects that are reinforcers will come to control responses that result in obtaining those objects. These responses will also be quite varied—crawling toward, walking toward, running toward, climbing over and around obstacles, reaching and grabbing for, fighting and struggling for, asking, begging, and crying for a reinforcer. Later on, even more complex behaviors will come under the control of the reinforcing stimuli—working for, wheedling for, arguing for, flattering for, being ingratiating for, being respectful for, as well as competing for in various ways, acceptable and otherwise.

Thus, a wide variety of reinforcing stimuli will come to control a wide variety of these behaviors, which can be called "striving" behaviors. It should be noted also that although a stimulus will tend to control a wide number of "striving" responses, the specific response that occurs will also be a function of other controlling stimuli that are present in the situation. Although a reinforcing stimulus may control walking for and asking for behavior, the latter will be more likely to occur when there is another person present.

It would also be expected that the amount of reinforcement value of the stimulus as a variable would come to control variable strengths of these "striving" behaviors. For example, when the stimulus has much reinforcement value it will reinforce strongly the behavior that obtains it, and thus come to control strong behavior. When the reinforcer is weak it will only weakly control striving behavior.

Now, as will be supported in the next two studies, it would be expected from the application of another learning principle, that any new reinforcing stimulus that was introduced to an individual would immediately control his behavior in the ways just discussed. Even though he had never been trained to strive for this particular object it would control this type of behavior simply because it had reinforcing value—the striving behavior already learned would generalize to the new reinforcing stimulus.

The critical principle here is mediated generalization as it has been described in several previously presented selections. In describing the principle in the present context, let us recall that reinforcing stimuli have a reinforcing property because they elicit a certain type of response—positive reinforcers elicit one type of response and negative reinforcers elicit another type of response. Unconditioned reinforcing stimuli, UCS^{R}, elicit this response without training, conditioned reinforcing stimuli, CS^{r}, elicit a "reinforcing" response through respondent conditioning. It should also be indicated again that responses have stimulus characteristics, and thus "positive reinforcing responses" would be expected to have different stimulus characteristics than "negative reinforcing responses."

With this as the basic theory, the way generalization of stimulus control (S^{D} value) established with one reinforcing stimulus will occur to a new reinforcing stimulus can now be outlined. That is, although several reinforcing objects may have very different stimulus characteristics otherwise—that is, different size, shape, color, texture, smell, and so on—they may still have a similar stimulus characteristic in that they all elicit a "positive reinforcing response" with its special stimuli. This may be schematized as follows: $CS^{r+} \longrightarrow r^{+}\underline{\hspace{2em}}\ s$ for a positive reinforcing stimulus, and $CS^{r-} \longrightarrow r^{-}\underline{\hspace{2em}}\ s$ for a negative reinforcer.

Now, whenever a reinforcing stimulus is involved in the process whereby it becomes capable, as an S^{D}, of controlling striving responses (making it a $CS^{r\&D}$), the stimulus characteristic of the reinforcing response will also become capable of controlling these striving responses, thus becoming an S^{D} also. This may be depicted as follows for positive reinforcers.

$$CS^{r+\ \&\ D} \longrightarrow r^{+}\underline{\hspace{3em}}\ s^{D} \longrightarrow R_{\text{"striving"}}$$

Thus, the stimulus of the positive reinforcing response actually becomes an S^{D} for the striving response. When this has occurred, that striving response will now be controlled by any new positive reinforcing stimulus since the new positive reinforcing stimulus will also elicit the $r^{+}\underline{\hspace{2em}}\ s^{D}$, and this mechanism will control the striving response.

With this analysis in mind, the next two studies may be more fully appreciated. The studies are examples in the area of social interaction of the formation (or change) of social reinforcers (attitudes) and the way in which this effects the power of those social stimuli to *control* the behavior of others.

In the study by Lott and Lott it was found that when child A has been reinforced in the presence of child B, child A will later select child B as a companion. Now, the behavior of selecting child B, or otherwise "striving" toward child B, was not reinforced in the presence of child B. The experimental conditions simply paired child B with positive reinforcement and would be expected to condition a positive reinforcing response (or attitude), an $r\underline{\pm\quad\quad}\,s^D$, to child B. However, as in the preceding analysis, since $r\underline{\pm\quad\quad}\,s^D$ would control a number of "striving" responses, including verbal responses of requesting child B's company, the results that occurred would be expected. Thus, the concepts of group attitudes and group cohesion can be related with an integrated set of learning principles. And the analysis of the manner in which the reinforcement value of a stimulus can control behavior striving toward that stimulus receives support from the results.

The next study by Bandura and Ross extends this analysis and gives it further support. In this study a child experiences the pairing of one adult with positive reinforcers, presumably conditioning in the child a positive reinforcing response, $r\underline{\pm\quad\quad}\,s^D$, to that adult. Later it is found that the child imitates this adult more than he does an adult who has not been paired with positive reinforcers. That is, the one adult, as he has become a stronger reinforcer, has also become a stronger S^D for imitating or following behavior. This would be expected from the analysis. As the $r\underline{\pm\quad\quad}\,s^D$ is conditioned to the adult, all the "striving" responses controlled by the $r\underline{\pm\quad\quad}\,s^D$ will be controlled by that adult.

Thus, Bandura's and Ross's results indicate that imitating or following behavior is at least in part under the control of the reinforcing value of stimulus objects or people as social stimuli. This opens the study of social power to the experimental methods and principles of learning. On the basis of these results it is suggested that a change in the reinforcing value of an individual will change his power as a stimulus in controlling other people's behavior in various ways. An increase in the reinforcing value of an individual will increase verbal and motor approach or companionable responses, respectful responses, affectionate behavior, following behavior, smiling, pleasant conversation, sympathetic responses, and the like.

It is important to indicate that there are two ways that the reinforcing value of a stimulus can be increased. Reinforcing value may be increased by various learning processes, as will be described. In addition, however, the reinforcing value of a stimulus for an individual can be increased by depriving the individual of that stimulus. Thus, both of these operations should also have the effect of increasing the S^D value of the stimulus. So all of the previous discussion concerning the S^D value of reinforcing stimuli should pertain to effects that can be obtained through deprivation operations. As an example, it would be expected that the imitation behavior obtained by Bandura and Ross would have occurred more strongly if the child had first been deprived of people (social reinforcers) as in the study of Gewirtz and Baer in the second Chapter.

(Conversely, the results of the alteration of reinforcement value obtained by Lott and Lott, and by Bandura, Ross, and Ross should also have implications for the experimental situation of Gewirtz and Baer. In Gewirtz and Baer's study, a marble-dropping response was strengthened by applying social approval to that response. It would be expected that making a person a stronger reinforcer through *any* of the mechanisms described in the present article would also increase his ability to mold behavior by giving approval, in addition to increasing his ability to bring on already learned behaviors such as imitation.)

It also follows that the S^D value of a reinforcing stimulus could be reduced by reducing its reinforcing value. This could be done by satiation operations, or by extinguishing the reinforcement value of a conditioned reinforcer, plus the other ways described herein.

All of the examples used in the above account have involved the way in which positive reinforcing responses ($r^{\pm}$ —— s^D) control a wide variety of striving behaviors. It should be recalled, however, that the principle would be expected to hold also with negative reinforcers. Negative reinforcers rather than controlling a class of striving responses will come to control the opposite, responses that carry one away from the stimulus object or that drive the stimulus object away. These responses, both verbal and motor, will include cruel behavior, derisive or insulting comments, obstructionistic behavior, antagonistic responses, oppositional voting, and the like. In addition, servile, cringing, afraid behavior, and so on, may also be acquired under the control of the negative reinforcing response. An increase in the negative reinforcing value of an individual through conditioning would be expected to insure that these overt responses would be more strongly controlled.

In the two articles that have been presented (by Lott and Lott as well as Bandura and Ross), the reinforcement value and hence S^D value of a social stimulus was changed by pairing the stimulus with positive reinforcing objects. It can be suggested that this is only one of several different ways that the reinforcement value of a social stimulus could be changed through conditioning. For example, the same process could be accomplished via moving or still pictures. It would thus be expected, using the procedure of Bandura and Ross, that if an adult was shown to "possess" many reinforcers in a film, his own reinforcement value as a stimulus would be increased, and consequently his S^D for controlling following behavior would also be increased. This suggests that reinforcement and S^D value can be changed through pictorial mass communication media.

In addition, it would also be expected that the change in the reinforcement value and S^D value of a person could also be changed purely through the function of language. In Selection 21 it was suggested that when a stimulus object is paired with word stimuli that elicit evaluative meaning responses (making these words reinforcing stimuli) the object will also come to elicit those evaluative meaning responses, that is, will also come to be a reinforcer. Thus, as the experiment in the preceding chapter showed, if words like *beauty, win, gift, sweet, honest, smart, rich, sacred, friend,* *valuable, happy, pretty, healthy, success, love,* and so on were paired with a person, that person would become a stronger positive reinforcer, and a stronger S^D capable of controlling many "positive" verbal and motor behaviors.

It would not even be necessary that the individual himself be paired with the word reinforcers. The same end could be achieved by pairing his name with the word reinforcers, as shown by the study of Di Vesta and Stover described in Selection 21, as well as Lott's study in the preceding chapter. It would also be possible to pair an individual's picture with the reinforcing words and thus produce the conditioning and its effects. For these reasons, the change of reinforcer and S^D value and the ways these influence group cohesiveness and other social interactions could be made via mass communication media—film, radio, television, newspapers, magazines, and books—as well as through face-to-face communication.

It should be possible to demonstrate the validity of these implications and the basic analysis in systematic experimentation. For example, it should be possible to enhance the leadership (social power) of an individual in Cohen's experimental procedure by increasing that individual's reinforcement value through direct or verbal conditioning of the various types mentioned. This could also be accomplished by "labelling" an individual with a name that has positive or negative reinforcement value, such as "doctor." It should also be possible in these various additional ways to change imitational control using the Bandura and Ross experimental procedures as well as the group cohesiveness of Lott and Lott.

The learning analysis also appears to have other implications. For example, concerning group prejudice, if a group's distinctive physical features, name, dress, language, or other behavior, elicits little positive reinforcing value, the members of the group will have little social controlling power. That is, members of the group will not be listened to, imitated, followed, chosen as a companion, and so on, or even hired, promoted, and so forth to the extent that members of groups will who have more reinforcement value. If the group, or its name, elicits negative reinforcing responses its members will be more likely to be insulted, avoided, opposed, arrested, rejected, fired, and so on, and in extreme cases, killed, lynched, and fought against. Verbal passages, films, or direct experience that presents members of the group, or its name, in contiguity with negative reinforcers would be expected to enhance the undesirable behaviors controlled by (made to) members of the group.

Matters of concern in the field of propaganda and advertising can also be incorporated into this learning analysis. One of the common techniques of the political editorial, for example, is to present the name of a political figure in contiguity with positive reinforcing words when the writer favors the politician or with negative reinforcing words when the writer is opposed. Each one of the pairings of name and reinforcing word may be considered to be a conditioning trial that changes the reinforcing value of the political figure's name and person. When that name or its owner appears on later occasions, the individual who has been so conditioned, taking the negative case as an example, will speak against the political figure and his principles, vote against him, fight against him, and so on.

Finally, even more far-reaching extensions of learning principles to social behavior have been suggested. Skinner (1953, 1961) has suggested that even the most complex aspects of human affairs may be understood in terms of reinforcement principles, for example, social institutions such as government, education, religion, and cultural change, albeit in very general terms. Based upon these considerations he has suggested that some cultural practices are more reinforcing than others and that cultural practices could be purposely designed to provide a more propitious environment for man.

The present author (see Staats and Staats, 1963) has suggested several mechanisms of a learning nature that could result in social evolution or change. For example, it was suggested that the various activities we call science are the behaviors of men subject to the principles of conditioning. These behaviors were seen as emerging into a more dominant position in our society because they result in greater reinforcement than other competing behaviors. Scientific behavior has become more dominant because it results in avoiding aversive natural occurrences and obtaining positive reinforcers. The scientific behavior should consequently become more dominant in the society through several mechanisms. First, reinforcement will strengthen the behavior in the individual. In addition, however, others who are around this individual will experience positive reinforcement in his presence. This will give him greater social power and enable him to influence the behavior of a larger number of people. It will also put him in a position within the society where he will influence a much larger number of people through communication media, as occurs when the individual becomes a member of a university faculty. The individual whose behaviors do not result in positive reinforcement for himself and others will in competition find his influence weakening. In addition, social practices or social systems that differ in the extent to which they result in reinforcement (positive or negative), will control differing extents of "striving" behavior. Social practices or systems that result in stronger positive reinforcers will control stronger supportive behaviors than a competitive practice or system that results in little positive reinforcement or much negative reinforcement.

A full discussion of these matters is not possible herein. Perhaps the potential productivity of the approach has been suggested, however. Thus, the learning analysis, an integration of principles of operant and respondent conditioning, appears capable of extension to an understanding of evaluative word meaning, attitude formation and function, social interaction, group cohesiveness and prejudice, individual social power, propaganda, and perhaps even such broad social phenomena as social change and the evolution of social practices.

32.

A Functional Analysis of Authority*[1]

J. Stacy Adams and
A. Kimball Romney

An important segment of social interaction that requires systematic analysis is the behavioral control of one person over another: in other words, authority. The purpose of this paper is to analyze this type of interaction for the dyad, showing of what variables it is a function.

Authority, as defined below, is seen as a special case of verbal behavior as analyzed by Skinner (1957), and is consonant with his definition of the "mand." Thus, the analysis of authority will make fundamental use of the concept of the reciprocal reinforcement of behavior. The general aim is to carry through an analysis of the dyadic situation, and simple extensions of it, that specifies the conditions that are relevant to the occurrence of "authority behavior" and the variables of which such behavior is a function.

We begin with a definition of authority. A basic paradigm of an authority sequence will then be given and the variables of which such an authority sequence is a function will be discussed in detail. Finally, functional relationships between authority sequences will be analyzed.

Definition of Authority

We define authority as follows: Person A has authority over Person B, in a given situation, when a response of A, under the control of deprivation or aversive stimulation and specifying its own reinforcement, is reinforced by B.

This definition implies that authority is a social relation under the dual or reciprocal control of both A and B. It is social in the sense that it requires behavior on the part of both A and B and that the behavior of A constitutes a stimulus for B and vice versa. For the relation to be maintained, B's behavior must be reinforcing for A and A's behavior must be reinforcing for B. As will be discussed later, the controlling relation of A over B may be enduring or temporary, and it may extend over a large or small range of B's responses.

The relation of authority is asymmetri-

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* From J. S. Adams and A. K. Romney, A functional analysis of authority, *Psychol. Rev.*, **66**, 234-251 (1959). Reprinted by permission of the authors and the American Psychological Association.

[1] This paper was written at the Interdisciplinary Program in the Behavioral Sciences at the University of New Mexico, Summer, 1958, sponsored by the Behavioral Sciences Division, Air Force Office of Scientific Research, under Contract AF 49 (683)-33. We gratefully acknowledge their support.

cal in that A's initial response (such as a command, request, suggestion, etc.) specifies its own reinforcement, whereas B's does not. The reinforcement is provided by B's response, if the response reduces the state of deprivation or withdraws aversive stimuli for A. For the maintenance of the relationship B's response must be likewise reinforced by A, but the reinforcement is not specified as in the case of A.

The phrase, "in a given situation," indicates that the authority relation is not assumed to be a general one between individuals regardless of time and place. Authority is learned in specific situations, although it may later be transferred to other situations by such processes as stimulus induction. The phrase also implies the reversibility of the relation from one situation to another. This reversibility may violate the usual definition of and feeling for "authority." For example, one readily accepts the notion of a father's authority over his son, while one would balk at a statement of a child's "authority" over his father. Yet, precisely the same functional relationships may hold in both cases, as we shall demonstrate. It is, therefore, both rigorous and useful to speak of a person's having "authority" over another whenever the same relationships are found, even though this practice might do violence to everyday usage.

The clause, "under the control of deprivation or aversive stimulation," indicates that it is not sufficient to know only the topography of the response of A, but that it is also necessary to specify the controlling variables of the response of A. For example, if A says, "Water, please," in the presence of B, we must know whether the controlling variable of that response is water deprivation or some other deprivation, or whether it is aversive stimulation.

When it is said that the response of A specifies its own reinforcement, we assume that there is "communication" between A and B. Not only does the presence of B, in part, set the occasion for the response of A, but the reinforcement of A's response is contingent upon a response by B. Thus authority behavior is necessarily verbal behavior as defined by Skinner (1957), i.e., behavior the reinforcement of which is contingent upon stimulation of and response by another individual. The definitions of all other terms used in the analysis closely follow the behavioral, empirical definitions given by Verplanck (1957).

Basic Paradigm of an Authority Sequence

The central idea in authority relations is that of the reciprocal control and reinforcement of behavior of two persons. Basically, the paradigm is that a response of one person, A, is reinforced by another person, B, and that, in turn, the reinforcing response of B is, itself, reinforced by A. Such an interaction will be called an *authority sequence*. An example is the situation in which Person A asks B for water and B complies by giving A water. Figure 1 gives an illustration of the process. The figure is divided into two parts, the top half representing stimuli and responses directly related to Person A, while the lower half pertains to Person B. The interaction between A and B begins at the far left of the figure with A in a state of deprivation and in the presence of a discriminative stimulus, S_d and $S_B{}^D$. These stimuli set the occasion for the response R_{A1}, "Give me water." S_d is the stimulus, presumably physiological in the example, that results from water deprivation. $S_B{}^D$ is the discriminative stimulus resulting from B's presence in A's environment.

S_B^D is a discriminative stimulus with respect to R_{A1} in this illustration by virtue of previous conditioning. The response, "Give me water," would not occur unless A were thirsty; nor would it occur unless someone were present to give A water. In some sense, R_{A1} is "appropriate" only in the presence of S_d and S_B^D, and these stimuli may therefore be viewed as "setting the occasion for" and as having control over R_{A1}. As will be seen, this control is not exclusive, however, for it is the reinforcement of R_{A1} in the presence of the two stimuli that is crucial for the demonstration of authority.

Once the verbal command, "Give me water," will be reinforced by giving water to B. Specifically, it is a discriminative stimulus, S_{A1}^D, in that it sets the occasion for a response by B that is later reinforced. The major characteristic of R_{A1} is that it specifies how B can reinforce it. B is in fact "told" that the response, "Give me water," has been emitted, it is a stimulus to A. When B gives water to A, his response, R_{B1}, constitutes the reinforcement, S_{B1}^R of response R_{A1}. In addition, R_{B1} is also a discriminative stimulus, S_{B1}^D, that sets the occasion for a further response by A. The response in this example is, "Thank you," R_{A2}. In turn, R_{A2}, a generalized reinforcer, constitutes a reinforcement of R_{B1}. Although the reciprocal reinforcement of responses on that part of A and B is terminated arbitrarily in the present example, R_{A2} itself would need to be reinforced by a further response of B, perhaps the verbal response, "You're welcome," or a nod or smile. As the dots to the far right of Fig. 1 suggest, the sequence is theoretically infinite, though in practice it is finite.

The use of only one discriminative stimulus (S_B^D) is greatly simplifying a situation encountered in "real life." The essence of the model is in no way affected by this simplification, however. Quite complex stimuli could be made discriminative—i.e., given "sign" status—in an experimental situation, and an authority sequence from "real life" could be replicated.

In the illustrative sequence of behavior presented, it is important to note that if the sequence is interrupted at any point, predictable consequences follow. Assume, for example, that B does not give water to

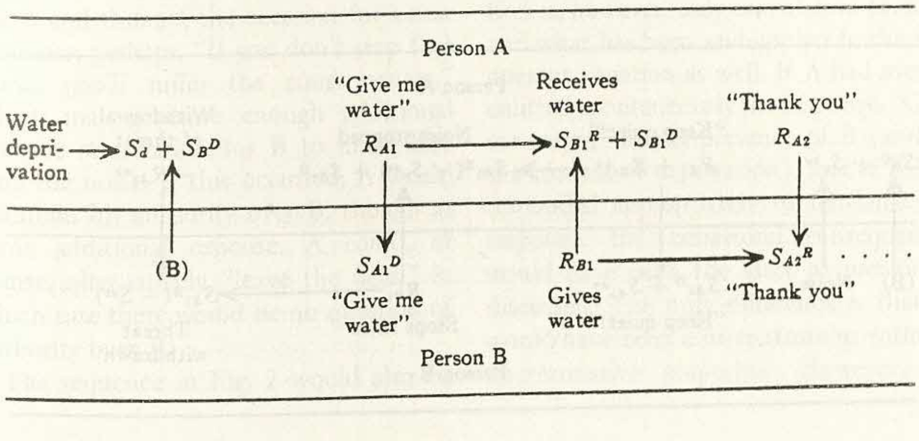

FIG. 1. Authority sequence with initial response under control of deprivation. From Adams and Romney: A functional analysis of authority.

A, after A has said, "Give me water." This might be because R_{A1} did not result in a discriminative stimulus for B, i.e., it had no "meaning" for B because of lack of previous learning. Or it may be that R_{A1} resulted in a discriminative stimulus that set the occasion for a response other than giving water, perhaps telling A to get his own water. Whatever the reason for not giving water to A, the consequence would be for R_{A1} to undergo some extinction. Similarly, if the sequence were interrupted by A's not emitting R_{A2}, B's response, R_{B1}, giving water, would undergo some extinction, with the result that the probability of R_{A1}'s being reinforced would be decreased. As before, the probability of A's emitting R_{A1} would then be smaller. In both instances where the sequence is interrupted, it is evident that A's authority over B is decreased, at least in this particular situation. It is interesting to note that in the first instance the decrease in A's authority is primarily "because" of a failure attributable to B. In the second instance, however, A's authority is affected "because" of his failure to reinforce B's response, R_{B1}. The use of "because" here is very loose, of course; no attribution of causality to A and B as persons is intended. Their responses are completely determined, except on their very first occurrence, by their previous reinforcement history and by antecedent stimulus conditions.

In Fig. 1, A's initial response was partly under the control of deprivation. Instead it could have been under the partial control of aversive stimulation. For example, B might have been making some disturbing noise and this aversive stimulus might have set the occasion for the response, "Keep quiet!" It is also true that B's response, R_{B1}, need not necessarily be reinforced by the presentation of a positive reinforcing stimulus. It could have been reinforced by the withdrawal of an aversive stimulus or conditioned aversive stimulus. Figure 2 shows how aversive stimuli might exercise control in an authority interaction.

An aversive noise stimulus, S_n^{av}, and a discriminative stimulus, S_B^D, set the occasion for the responses R_{A1} and R_{A1}^{av}, constituted by the verbal response, "Keep quiet!" and an implied threat carried by the accentuation and intonation of the verbal response. Thus B is presented with a discriminative verbal stimulus, S_{A1}^D,

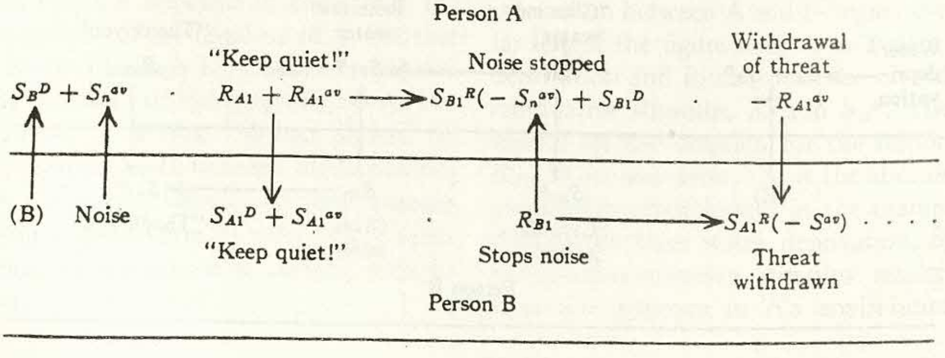
Person A
"Keep quiet!"
Noise stopped
Withdrawal of threat
$S_B^D + S_n^{av}$ · $R_{A1} + R_{A1}^{av} \longrightarrow S_{B1}^R(-S_n^{av}) + S_{B1}^D$ · $-R_{A1}^{av}$
(B) Noise
$S_{A1}^D + S_{A1}^{av}$ · $R_{B1} \longrightarrow S_{A1}^R(-S^{av})$ · · · ·
"Keep quiet!"
Stops noise
Threat withdrawn
Person B

FIG. 2. Authority sequence with initial response under control of aversive stimulation. From Adams and Romney: A functional analysis of authority.

and a conditioned aversive stimulus, S_{A1}^{av}. These stimuli set the occasion for stopping the noise, indicated in the figure as R_{B1}. This response consists of the withdrawal of the aversive noise stimulus, S_n^{av}, and constitutes a negative reinforcing stimulus for A, as well as a discriminative stimulus, S_{B1}^{D}, setting the occasion for a further response. The response, in this example, is the withdrawal of implicit threat and is labelled, $-R_{A1}^{av}$. This, in turn, is an appropriate negative reinforcing stimulus for B's response, R_{B1}. As in the previous example, the sequence of behavior is stopped at this point. Thus, we have here an interesting case of escape conditioning, with an implied threat as a conditioned aversive stimulus, as well as one of avoidance conditioning with respect to the negative reinforcing stimulus inferred from the threat.

In a manner analogous to that presented earlier, interruption of the behavioral sequence has implications for the authority A has over B. If B, for example, does not stop making noise (perhaps because of the inadequate control of S_{A1}^{D} and S_{A1}^{av}), A's response, "Keep quiet!" will undergo some extinction and A's authority over B will be weakened under the particular circumstances described. However, B's lack of compliance may of itself constitute additional aversive stimulation for A and thus set the occasion for a new response, perhaps, "If you don't stop that noise, you'll suffer the consequences," which may generate enough additional aversive stimulation for B to make him stop the noise. If this occurred, A would maintain his authority over B, though at some additional expense. A could, of course, alternatively "leave the field," in which case there would be no question of authority over B.

The sequence in Fig. 2 would also be interrupted if A did not withdraw aversive stimulation after B had complied with his command. The consequence would be that R_{B1} would have less likelihood of occurring in the future, a fact which would tend to reduce the probability of occurrence of R_{A1} and R_{A1}^{av} and, therefore, would tend to reduce A's authority over B in this illustrative situation. As was pointed out before, the resulting loss of control of A over B might set the occasion for new responses by A.

In both the illustrations given thus far, certain assumptions have been made which need to be made explicit before the implications of the paradigm are further explored. Some of the assumptions concern the discriminative status of stimuli. For example, it is assumed in Fig. 1 that B is a discriminative stimulus (S_B^{D}) setting the occasion for the response, "Give me water." But by definition a discriminative stimulus is one in the presence of which a response is reinforced and in the absence of which it is unreinforced. Since A's response, R_{A1}, is not reinforced until some time later, B cannot initially be a discriminative stimulus in the sense of setting the occasion for R_{A1}. What is assumed, then, is some previous learning, i.e., some previous temporal contiguity of response (R_{A1}) and reinforcing stimulus (S_{B1}^{R}) in the presence of B. The assumption is, however, only one of convenience, and what has been said applies to the free operant situation as well. If A had merely emitted spontaneously the response, "Give me water," in the presence of B (and in the context of deprivation), and if B had responded appropriately to reinforce A's response, the behavioral consequences would have been the same as previously discussed. The only difference is that B would have been a mere stimulus without discriminative properties. However, on *subsequent* occasions B would have discriminative characteristics, assuming further that A's responses had been unreinforced on some occasion when B was absent. The same line of reasoning applies to other stimuli which appear as discriminative stimuli in the figures.

Another assumption is that the reciprocal reinforcement of behavior is a finite sequence. It was stated earlier that the reciprocal reinforcement sequence in the authority relation may be theoretically infinite but that we assumed it was finite in practice. The assumption is difficult to substantiate even though everyday observation suggests that persons in an authority relation do not reinforce each other's responses ad infinitum. There are, of course, cases where reinforcement continues for considerable lengths of time, for example the endless exchange of bows that occurs when a Westerner visits a Japanese home. Nevertheless, the fact is that in our culture the interaction usually stops at approximately the point indicated in Figs. 1 and 2, and that extinction is not a consequence. The reason for this may be that terminating an interaction sequence at a certain point is of itself reinforcing in that it avoids aversive consequences which would be forthcoming were the sequence not terminated. Thus, for example, in our own culture there are conventions about the termination of an interaction sequence beyond which further responding is punished by the use of conditioned aversive stimuli. As an illustration, it is commonly observed that after compliance with a request, anything beyond a "Thank you" and "You're welcome" results in raised eyebrows, a sardonic smile, or a look of impatience, which may be discriminative stimuli for stopping the interaction. When the stimuli for stopping are not known to one of the parties in the interaction (i.e., are not discriminative), responding may continue for some time, as in the bowing example above. In some situations responding beyond a given point may have the aspect of impertinence and have appropriate aversive results. Alternatively, responding beyond a certain point is unreinforced by society, and an agreed-upon sequence of reciprocal reinforcement becomes a discriminative stimulus for stopping to respond further.

Controlling Variables

Thus far it has been shown how an authority relation between two persons can evolve and either be maintained or be destroyed. The external events (independent variables) of which responses (dependent variables) in an authority interaction are a function will now be discussed. This will be done by grouping variables into general classes and discussing instances under class headings. The basic A-B interaction paradigm will be used throughout.

REINFORCING STIMULUS VARIABLES

Stimulus events that have the property of increasing the probability of recurrence of a preceding response are fundamental controlling variables. B's giving water to A and A's saying "Thank you" in Fig. 1 are such events in that they increase the probability of A's again asking B for water when he is later water-deprived, and of B's giving A water, respectively, other variables remaining constant. In other words, certain responses such as "Give me water" have consequences which empirically increase their probability of recurrence and thus in part determine the authority A has over B.

The importance of reinforcing stimuli is more pervasive than has been suggested above, however. The discriminative character of other stimuli is dependent upon their being paired with reinforcement. Thus, for example, in Fig. 1, B's presence would not constitute a discriminative stimulus for A's demanding water, unless it had been temporally contiguous with the reinforcement of A's response. Nor, in Fig. 2, would A's verbal command "Keep quiet!" be a discriminative stimulus for B's stopping noisiness, unless stopping to make noise had been reinforced following the occurrence of the stimulus resulting from A's response. It can therefore be seen that a reinforcing contingency is *necessary* before a stimulus can acquire discriminative properties. This is, of course, not a *sufficient* characteristic: It is also required that the absence of a stimulus be associated with nonreinforcement before it can be a discriminative stimulus. For example, with respect to Fig. 1, it would be necessary that A's response, "Give me water," be unreinforced in the absence of B.

The withholding of reinforcing stimuli following a response is the operation resulting in experimental extinction and, as an observable consequence, produces a decreased probability of response. Illustrations of this have been given previously.

The general properties and the importance of reinforcing stimuli having been pointed out, A and B as the agents or mediators of reinforcement must now be considered.

A AS A REINFORCER

A can act as a direct mediator of reinforcement or as a conditioned reinforcer. As a direct mediator he can both present positive reinforcers (or conditioned reinforcers) and withdraw negative reinforcers (or conditioned negative reinforcers). A father can reinforce his child for obeying a command by giving it candy. The business executive can reinforce his secretary's compliance with an order by withdrawing an implied threat, much as in the example of Fig. 2. In a similar fashion the traffic policeman reinforces stopping at his gestured command by lowering his arm and, hence, removing conditioned negative reinforcers.

It is evident that, as a direct mediator of reinforcement, A can exercise considerable control over B's behavior. But it is also true that, indirectly, he exercises control over his *own* responses, for the probability of recurrence of his own responses is in part a function of the extent to which he is successful in reinforcing B's responses. Other things being equal, then, A is in some sense the master of his own authority over B. This notion is not a new one, but in the present case it has the advantage of being systematically derivable from the basic model.

A further derivation is that A's probability of successfully developing or maintaining an authority relation over B will in part be a function of the amount and variety or range of reinforcers he has available. The person who can mediate reinforcements appropriate to several states of deprivation can exercise more authority than one who can, say, provide only food (e.g., a parent versus a neighbor). The person who has access to a large range of aversive stimuli can have more authority than one who has not (e.g., a company commander versus a corporal). From a similar consideration it also follows that the greater the amount and range of reinforcers available to A, the greater the range of B's responses he can control, other variables remaining constant. Thus a parent can have wider authority than an older sister who can mete out limited punishment only and who has no money for material rewards.

As a conditioned reinforcer, either positive or negative, A may also exercise control over B's behavior, as well as indirectly over his own. Before he can act as a conditioned reinforcer, however, it is necessary that he have acted on previous occasions as a direct mediator of reinforcement, or, at least, that he be similar to someone who acted as a reinforcer. The important thing to consider is that the mere presence of A can reinforce some of B's responses, no direct reinforcement being given. For example, using the illustration of Fig. 1, it is possible for A to omit saying, "Thank you," and for B's response to remain at considerable strength, provided stimulus attributes of A have become conditioned or generalized reinforcers by virtue of A's having previously, and frequently, reinforced B's responses. However, in order for the attributes of A to remain effective conditioned reinforcers (and discriminative stimuli as well), it is necessary that on occasion A mediate direct reinforcement; otherwise B's operant will undergo extinction. The same applies to A qua A as a negative conditioned reinforcer.

B AS A REINFORCER

The distinguishing characteristic of B as a reinforcer is that his reinforcing response has no, or only a few, degrees of freedom, as contrasted with A as a reinforcer. His reinforcing response is specified by A, by definition. To be sure, the discrete topography of his response may vary, but its net effect on A is specified. Thus, for example, B may get and bring water to A in a variety of ways, but the giving of water is the essential property of the response that will reinforce A's request and, therefore, establish or maintain the authority relation.

In a manner similar to A, B may also act as a conditioned reinforcer or negative conditioned reinforcer, in that the authority relation between the two will be maintained or strengthened. This presumes, of course, that B, or someone similar to B, will have appropriately reinforced A's behavior in the past under similar circumstances.

GENERALIZATION OF *A* AND *B* AS CONDITIONED REINFORCERS

It has been pointed out that A and B may exercise control over each other's behavior, and thus maintain or strengthen an authority relation, in their capacities as conditioned reinforcers. It is also true that conditioned reinforcement may be effected by individuals other than A and B who have physical properties similar to A and B. Thus, an officer never before encountered may act as a conditioned reinforcer of an enlisted man's compliance with an order, by virtue of the fact that he has properties similar to those of other officers who have reinforced the same response. The dimensions of similarity in this example might be the uniform and emblems of office; or the relevant dimension might be physical characteristics of verbal operants, e.g., " 'ten shun!" Similarly, the authority of policemen is partially maintained, even though never before seen personally, through stimulus induction. How often has one slowed down at the sight of an unknown policeman whose back was turned?

DEPRIVATION AND AVERSIVE STIMULUS VARIABLES AFFECTING *A*

As stated in the definition of authority, A's initial response (order, command, request, demand, etc.) is partially under the control of deprivation or aversive stimulation, other control being exercised by discriminative stimuli (e.g., the presence of a B). This results from the fact that certain responses of the human organism are typically followed by specific consequences under certain conditions agreed upon by the social community, and that when this occurs the probability of occurrence of these responses will be a function of the deprivation or aversive stimulation paired with the reinforcing consequences. Thus the response, "Give me water," has a greater probability of occurrence under water deprivation than under satiation because other organisms are more likely to have provided water when A emitted this response and was thirsty. It should be noted that deprivation and aversive stimulation do not *necessarily* exercise control over the response. The control results from the fact that other organisms are predisposed by "societal consensus," so to speak, to respond in certain characteristic ways. This predisposition of other organisms is analogous to certain automatic consequences of the nonanimal environment. For example, picking and eating an apple is automatically reinforcing when the organism is food-deprived, though not if he is satiated. Thus, food deprivation would come to control picking and eating an apple. A similar line of reasoning applies to aversive stimulation, though in this case reinforcement consists in the withdrawal of an aversive stimulus.

The relations holding between deprivation (or aversive stimulation), response topography of A, and reinforcing response by B are stated in idealized terms. This is especially true with regard to A's response topography "specifying" its reinforcement. It is conceivable, for example, that the response, "Give me water," specified not a state of water deprivation which could be reinforced by water but rather a demand for submissiveness on the part of B, the state of deprivation being for something other than water. In such a case the content of A's response does not clearly specify the appropriate reinforcing stimulus—at least the words used do not clearly convey the state of A's deprivation. However, other aspects of the verbal response than the words may serve as appropriate discriminative stimuli for submissiveness (i.e., sheer compliance). The imperative mood of the response, for example, may serve this function. Whether it does this effectively on a particular occasion is, of course, a function of appropriate previous differential reinforcement. To put it somewhat loosely, it is a function of whether B has learned that use of the imperative mood is a "sign" for compliance regardless of the specific content of A's response.

DISCRIMINATIVE STIMULUS VARIABLES

In the discussion of Figs. 1 and 2 the role of discriminative stimuli was made explicit. We wish to expand the discussion at this point and focus specifically on the discriminative stimuli that control A's initial response. The discriminative stimulus characteristics of responses by A and B will be omitted, as they are evident.

Two general groups of discriminative stimulus variables controlling A's initial response may be considered, stimulus characteristics of B and situational stimuli, excluding B. A general characteristic of B that may serve as a discriminative stimulus is his being an organism with the potentiality of responding. Without another person's being present, a response by A cannot be reinforced, and A cannot exercise any authority. There are, however, other relevant aspects of B. One is B as a particular individual, i.e., the stimulus characteristics of a B who has previously reinforced A's response, as opposed to a B who has not. A second is B as the incumbent in a particular role, as an office boy or corporal, for example. In this instance characteristics of B serve as discriminative stimuli for a comparatively narrow range of responses by A. In other instances characteristics of B may set the occasion for one class of responses only; for example, the elevator boy is a discriminative stimulus for the response, "Take me to the sixth," only. Thus we may think of B as having discriminative stimulus characteristics that exercise control over A's responses with different degrees of specificity. The specificity of control exercised is a function of the extent of differential reinforcement carried out in the presence of particular characteristics.

The second group of discriminative stimulus variables are situational variables. They include virtually all relevant stimuli not directly pertaining to B. Some situational variables are part of the purely physical environment. Thus, the request, "Take me to the sixth," has a low probability of being reinforced in the absence of an elevator. Similarly, "Give me water," will usually have a low probability of occurring without a source of water in the immediate environment. However, in an instance of this sort, deprivation may become so severe that it exercises almost exclusive control. The "Water, water!" of the wounded soldier on the deserted battlefield is an example. Other situational variables are of a more "social" character in that the presence of other persons, or of persons having particular types of interaction, has a controlling discriminative stimulus function. Certain kinds of commands or requests are not issued to one's wife at home in the context of a cocktail party (and would go unreinforced, if issued), though they are issued and reinforced when just family members are present. Orders may be successfully given to an employee at the office, though not at the country club.

Whether discriminative stimulus control is exercised by B proper or by situational variables, it will be achieved only after differential reinforcement. The controlling stimulus variables may, of course, be of great complexity and require considerable training. For example, an authority response, R_{A1}, will be reinforced only if Stimuli I, J, . . . , or N are present, *and* if Stimuli B and C are present, *and* if Stimulus R is absent. The situation is analogous to those encountered in concept formation studies (e.g., Bruner, Goodnow, & Austin, 1956). In the present instance a response is reinforced only in the presence of particular stimuli, whereas in concept formation studies a response is said to be "correct" in the presence of some stimulus combinations and "incorrect" in the presence of other combinations.

Since complex stimulus control of this type requires considerable training with differential reinforcement, it follows that in early stages of training control will be imperfect. Some variables, in the absence of others which are necessary for reinforcement, will exercise some control over a response, even though it will not be reinforced. It is also possible that during the course of differential training "irrelevant" variables would exercise some control over an authority response. This inappropriate control of stimuli results when a response is reinforced in the presence of both appropriate discriminative stimuli and irrelevant other stimuli. These stimuli then acquire some discriminative stimulus capacity. Their control is eventually weakened and abolished during further differential training.

REFERENCES

Bruner, J. S., Goodnow, J. J., & Austin, G. A. *A study of thinking*. New York: Wiley, 1956.

Skinner, B. F. *Verbal behavior*. New York: Appleton-Century-Crofts, 1957.

Verplanck, W. S. A glossary of some terms used in the objective science of behavior. *Psychol. Rev.*, 1957, **64** (6), Part 2.

33.

The Influence of Reinforcement and Punishment in a Minimal Social Situation*[1]

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Leon Tabory

The study of conditioning in the laboratory, and the development of conditioning theory (3, 5, 6), are justified in part by the hope that the principles derived will ultimately enhance our understanding of human behavior in complex situations including social ones. The realization of such hopes is commonly relegated to some future time, and the path along which we expect to proceed is specified in the vaguest terms. In attempting to approach this problem, several questions may be raised: (*a*) Is it possible to handle social behavior within the framework of current conditioning theory, and if not, at what point along a scale of increasing complexity is it necessary to introduce additional concepts? (*b*) What new conceptual and analytical tools are necessary to handle the additional complexity encountered?

In the present study we attempt to reevaluate the essential features of a social situation as viewed entirely within the framework of conditioning theory, and to investigate the simplest situation that could be considered truly social within this framework. In this way, we hope to lay the groundwork for a systematic investigation of social situations of increasing complexity, and to clarify methodological and theoretical problems. Analysis of social behavior in these terms implies that no assumption whatever is to be made regarding such concepts as attitude, understanding, awareness, etc. If such factors enter the picture at all, they are to be considered as manifestations of complex habits. Preferably, they will not be encountered at all in the minimal social situation, and in any event cannot be part of the definition of social behavior.

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* From J. B. Sidowski, L. B. Wyckoff, and L. Tabory, The influence of reinforcement and punishment in a minimal social situation, *J. abnorm. soc. Psychol.*, **52**, 115–119 (1956). Reprinted by permission of the authors and the American Psychological Association.

[1] The writer wishes to thank Dr. David A. Grant for his helpful suggestions.

When restrictions such as these are accepted, we arrive at a conception of social behavior that will, no doubt, seem strange to most social psychologists. However, we gain the advantage of having a system that allows for a high level of objectivity in our definitions and principles, and one that is readily related to the mass of careful investigations of conditioning (3, 4, 5, 6). In this analysis we will assume that the main factors controlling social behavior are reinforcement (reward) and punishment. Within this framework, the essential features of a social situation may be expressed as follows: (*a*) Two or more *S*s have at their disposal responses which result in reinforcing or punishing effects on other *S*s. (*b*) The principal sources of reinforcement and punishment for any *S* depend on responses made by other *S*s. (c) The responses controlling reinforcement and punishment are subject to learning through trial and error. We will assume that, whatever else may be involved, at least the above features are present in any social situation. At this point we may ask what learning would be predicted on the basis of these conditions alone, assuming only that the principles of conditioning theory are operating. In the present experiment an attempt was made to place *S*s in a situation involving only these minimal features.

Two *S*s isolated from each other were provided with push buttons by means of which each could give the other reinforcement or punishment (score or shock). The effects of previous social learning were minimized, since *S*s were not told (nor did they guess) that they were in a social situation at all.

In this situation, if *S* makes a response, he does not "suffer the consequences" directly. An *S* can influence the reinforcing and punishing features of his environment, only to the extent that his actions may change the behavior of the other *S*. Thus, if *A* makes a response which results in a reinforcement for *B*, we may expect *B* to continue with, or to repeat, his immediately preceding behavior. Similarly, if *A* makes a response which results in a punishment for *B*, we may expect *B* to tend to discontinue his immediately preceding activity. In addition, when *B* receives punishment, we will also expect an increase in his over-all activity level. These changes in *B*'s behavior have a direct effect on the reinforcement and punishment being received by *A*. Thus *A* does receive some consequences of his responses through an indirect but not entirely unlawful process.

It is not intended that this situation should be directly comparable to familiar everyday encounters. We generally enter social situations already equipped with a massive amount of prior learning relating to the effects of our behavior on others. For example, we have stylized ways of indicating approval or disapproval that are in effect methods of reinforcing or punishing others. On the other hand, in many situations, the responses we have learned are no longer appropriate. For example, an adult who has had little experience with children may find that his habitual ways of expressing approval and disapproval are completely ineffective when he first begins to interact with a child. As he gains experience he learns new responses. Other illustrations could be cited. One occasionally encounters adults who react negatively to conventional reinforcements or punishments. The process through which this learning and relearning takes place will be central to any extension of conditioning theory into the realm of social behavior. We may ask, is face-to-face contact and "understanding" of the relationship between Ss necessary for this learning or would such learning occur simply as a result of the operation of reinforcement and punishment? It is questions such as these which we hope to answer through the present research program. The first step in this program is an investigation of behavior in the minimal situation.

The experiment. As indicated above, two Ss, isolated from each other, were given the opportunity to make responses which resulted in reinforcement or punishment (score or shock) for the other S. The general objective of the experiment was to discover what the course of learning would be under these conditions. It seemed likely that one of the most important parameters which would affect performance would be the magnitude of punishment used. Thus, two widely separated levels of shock were used for different groups of Ss.

Method

SUBJECTS

The Ss were 40 members of elementary psychology courses at the University of Wisconsin who received class points for participating.

APPARATUS

The two experimental rooms were each equipped with a control panel which provided two push buttons, an electrically operated counter, and a pair of electrodes. The right and left buttons in Room 1 controlled the counter and shock circuit in Room 2, and vice versa. Thus, pressing the right-hand button in Room 1 registered one point on the counter in Room 2, while pressing the left-hand button in Room 1 delivered an electric shock to the electrodes in Room 2. Similarly the buttons in Room 2 controlled the counter and shock in Room 1, except that the right and left buttons had the opposite effect. A small red light also blinked each time the counter was activated, and a white light served as a signal that the experiment had begun. The white light remained on until the session ended. The *E*'s control board contained counters which indicated the number of times that each of the four buttons had been pressed.

An electronic circuit provided for regulation of the shock current and automatic compensation for changes in S's resistance. Separate controls were available for each of the two Ss.

PROCEDURE

The 40 Ss, 20 pairs, were randomly assigned to two groups of 10 pairs each. The Strong-Shock group received shock current equal to 200 per cent of their absolute threshold, while the Weak-Shock group received 110 per cent of the threshold reading. Preliminary tests indicated that the absolute threshold was more reliable and more clearly defined than a "pain" threshold, so this measure was used as a basis for shock levels. The current used for the Strong-Shock group had a mean of .12 ma. and a standard deviation of .05, while the current used for the Weak-Shock group had a mean of .12 ma. and an *SD* of .07.

Although two Ss served during each experimental session, each *S* was led to believe that he was the only *S* serving in the experiment. At no time during or after the session were the Ss given any indication that another *S* had served in the experiment. Any questions concerning the current were ignored; however, each S was offered the opportunity to withdraw from the experiment before the session began. None of the Ss withdrew.

After the threshold readings were completed, S was taken to one of the two experimental rooms where he was seated before the S control board. Electrodes were attached to the first two fingers of his left hand. Instructions were then read to S, after which he was told to relax for a few minutes while the apparatus warmed up. During this time, *E* brought the second S before the *E* panel and went through the same procedure. The second S was taken to Room 2 and seated before the second control board. All Ss were given the following instructions:

"When the white light goes on the experiment begins. The experiment is in progress as long as the white light stays on. You can press either of these buttons in any manner that you wish, and as frequently as you wish. Do not attempt to press both buttons at the same time and use only your right hand for pressing. You are to keep your left hand on the table. Do not hold a button down, but just press and release it. The object of the experiment is to make as many points as you can. Your point score will appear on this counter. The red light will blink and the counter will turn each time that you score a point. When the white light goes off, it is a signal that the experiment has ended. Remain seated until *E* comes into the room. Remember, you are to try to make as high a score as you can in any manner that you can."

During the experiment, the four scores, a shock and a point score for each of the two *S*s, were recorded by *E* every 30 sec. over a period of 25 continuous minutes. This gave a record of 50 scores for each button on the two S control boards.

At the conclusion of the experimental session, a series of questions was asked in order to determine whether or not any of the Ss were aware of the presence of another S in the experiment.

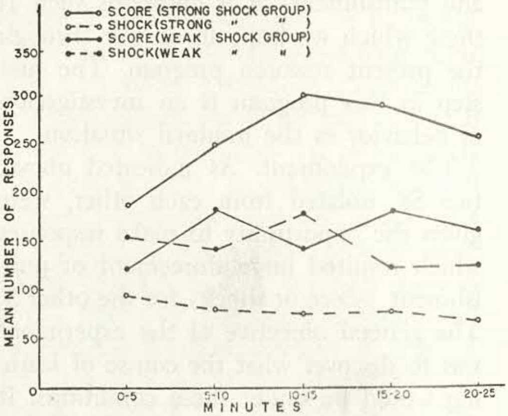

FIG. 1. Mean number of responses on the shock and score buttons by the strong-shock and weak-shock groups. From Sidowski, Wyckoff, and Tabory: The influence of reinforcement and punishment in a minimal social situation.

Results

In the initial analysis, scores over 5 minute intervals were tabulated for "score" and "shock" responses for each of the two groups. These data are presented graphically in Fig. 1. An Alexander trend test (1) was carried out on the data and the *F* was found to be significant beyond the .05 level of confidence. Duncan's test (2) for differences between ranked treatments was carried out on the ranked means (presented in Table 1) of the four button responses. The differences betwen all ranked means were significant well beyond the .05 level of confidence (an exception was the nonsignificant difference

TABLE 1

Ranked Means for the Four-Button Responses

RANKS	MEANS
Strong-shock button	397.85
Weak-shock button	719.95
Weak score button	786.75
Strong score button	1,288.65

From Sidowski, Wyckoff, and Tabory: The influence of reinforcement and punishment in a minimal social situation.

between the Weak-Shock—Weak-score means). In addition a ratio for each 5-minute interval was computed to give the proportion of the total responses which were "score" responses. These data are presented in Fig. 2. An Alexander trend test showed an *F* significant beyond the .05 level of confidence.

These tests showed that the Strong-Shock group yielded significantly more "score" than "shock" responses, while no such difference for the Weak-Shock group was found. The tests did not indicate that the slope of the curves, which would have reflected gradual improvement, was significant. Inspection of the curves suggested that our failure to show significant slopes might have been due to the fact that much of the learning had occurred within the first five minutes. Therefore, the data for the first five minutes were divided into 1-min. intervals and analyzed. These data are presented in Fig. 3. An Alexander trend analysis showed a significant difference between group slopes beyond the .05 level of confidence. This confirms our observation that learning took place within the first five minutes.

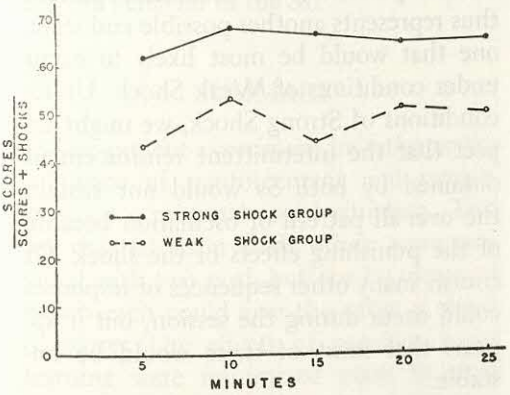

FIG. 2. Proportion of the total number of responses which were correct responses (score responses) during the 25-min. experimental session. From Sidowski, Wyckoff, and Tabory: The influence of reinforcement and punishment in a minimal social situation.

As a result of the preceding analyses, the major fact to be noted is that learning did occur in the Strong-Shock group, whereas no evidence of learning was obtained in the Weak-Shock group.

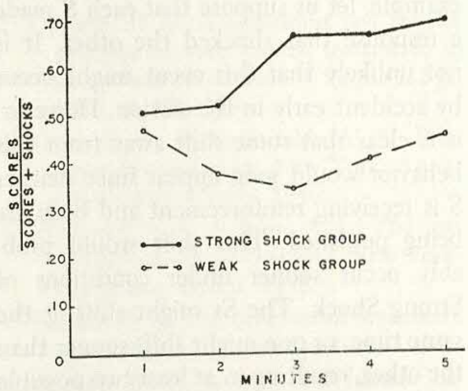

FIG. 3. Proportion of the total number of responses which were correct (score responses) during the first 5 minutes. From Sidowski, Wyckoff, and Tabory: The influence of reinforcement and punishment in a minimal social situation.

Responses to the questions at the end of the experiment indicated that none of the *S*s were aware that a second *S* was involved.

DISCUSSION

Two major questions may be raised regarding the experimental findings: (*a*) Why did learning appear in the Strong-Shock group but not in the Weak-Shock group? (*b*) Why did learning occur at all under the conditions of this experiment?

In order to answer these two questions it is necessary to examine some of the sequences of responses which may have occurred during the course of the experiment. Examination of all possible sequences of events that might occur in the two groups becomes too cumbersome for our present purposes. However, it will be of interest to consider a few examples of possible beginning sequences and possible end states. Generally, we might assume random behavior by both *S*s at the beginning of the experimental session. For example, let us suppose that each *S* made a response that shocked the other. It is not unlikely that this event might occur by accident early in the session. However, it is clear that some shift away from this behavior would soon appear since neither *S* is receiving reinforcement and both are being punished. This shift would probably occur sooner under conditions of Strong Shock. The *S*s might shift at the same time, or one might shift sooner than the other, resulting in at least two possible new patterns. If both shifted to the reinforcement button at the same time, both would now receive reinforcement and we would expect a tendency for this pattern to continue. (In fact, the same prediction would be made if *S*s commenced to reinforce each other at any time.) This pattern is perhaps the most obvious "self-sustaining" pattern which might emerge, and thus is one of the possible end states which might prevail. On the other hand, suppose that one *S* shifted to the reinforcement button before the other, or that, at any time, one *S* pressed the reinforcement button while the other pressed the shock button. The *S* who is pressing the reinforcement button should tend to shift to the shock button, with the result of reversion to the condition of both shocking each other. Since both of these patterns are "unstable," we might obtain a continual oscillation between the two states, with one *S* and then the other shifting temporarily to the reinforcement button. This oscillation itself would form a new pattern which could be stable under certain conditions, particularly if the magnitude of the shock were relatively small. If this magnitude were small enough, the intermittent reinforcement obtained by both *S*s might sustain the over-all pattern. This oscillatory pattern thus represents another possible end state, one that would be most likely to occur under conditions of Weak Shock. Under conditions of Strong Shock, we might expect that the intermittent reinforcement obtained by both *S*s would not sustain the over-all pattern of oscillation because of the punishing effects of the shock. Of course, many other sequences of responses could occur during the session, but it appears that most of these would be unstable.

Although the above considerations are not complete, they suggest a possible explanation for the occurrence of learning in the present experiment and the differential effect of the two levels of shock. It is suggested that under conditions of Strong Shock, the most probable stable pattern (end state) was that of both Ss reinforcing each other. Thus, Ss would tend to shift among patterns until they hit on this solution. (Some Ss could be expected to return to earlier responses, such as pressing the shock button from time to time due to the intermittent reinforcement which may have occurred early in the session following this type of response.) Under conditions of Weak Shock, the pattern of oscillation between the buttons was presumably the most probable stable state since any of several initial sequences could lead into this pattern. It was not possible to analyze the sequential patterns in the present experiment, so further experimentation would be necessary to test these interpretations.

Within the framework of the present experiment, we can conclude that learning was demonstrated in a minimal social situation where: (*a*) the effects of previous social learning had been minimized, and (*b*) reinforcement and punishment were the only observable factors influencing the behavior of the Ss.

SUMMARY

The present experiment investigates the influence of reinforcement and punishment in a minimal social situation. Two Ss, isolated from each other, were provided with two push buttons by means of which each could give the other a shock or score. The effects of previous social learning were minimized since Ss were unaware of the fact that they were in a social situation at all.

The Ss were divided into a Weak Shock and a Strong Shock group. All Ss were merely told that they could press the two buttons in any manner that they pleased (no information was given concerning the purpose of the buttons). Each *S* was also told that he was to make as many points as possible. His score was indicated on a counter which was mounted in front of *S*.

It was found that the proportion of the total number of responses (both score and shock) that were correct (score responses) was significantly higher for the Strong-Shock group. Learning occurred in the Strong-Shock group within the first 5 minutes of the 25-minute experimental session. Learning was not, however, evident in the Weak-Shock group.

Principles of reinforcement were used to interpret the results.

REFERENCES

1. Alexander, H. W. A general test for trend. *Psychol. Bull.*, 1946, **43**, 533–557.
2. Duncan, D. B. A significant test for differences between ranked treatments in an analysis of variance. *Virginia J. Sci.*, 1951, **2**, 171–189.
3. Keller, F. S., & Schoenfeld, W. N. *Principles of psychology*. New York: Appleton-Century-Crofts, 1950.
4. McGeoch, J. A., & Irion, A. L. *The psychology of human learning*. New York: Longmans, Green, 1952.
5. Skinner, B. F. *The behavior of organisms*. New York: Appleton-Century, 1938.
6. Skinner, B. F. *Science and human behavior*. New York: Macmillan, 1953.

34.

The Reinforcement of Cooperation Between Children*[1]

Nathan H. Azrin and
Ogden R. Lindsley

Most methods for the development and experimental analysis of cooperation between humans require specific instructions concerning the cooperative relationship between the individual responses. Peters and Murphree have developed one of the most recent of these methods (1). Skinner has suggested (2), and shown with lower organisms (3), that cooperation between individuals can be developed, maintained, and eliminated solely by manipulating the contingency between reinforcing stimuli and the cooperative response.

The advantages of eliminating instructions concerning cooperation are that (*a*) the initial acquisition of cooperation can be studied, (*b*) subjects (Ss) that learn by demonstration and instruction with difficulty (i.e., infants, certain classes of psychotics, and lower organisms) can be studied, and (*c*) no problems involving the effects of instructions upon the behavior of the Ss are involved.

Some more general advantages of operant conditioning techniques are (*a*) a more continuous record of the cooperative process is obtained, (*b*) extraneous environmental variables are minimized, and (*c*) relatively long periods of experimental observation are possible.

Problem

Can cooperation between children be developed, maintained, and eliminated solely by the presentation or nonpresentation of a single reinforcing stimulus, available to each member of the cooperative team, following each cooperative response?

COOPERATIVE TEAMS

Twenty children, seven to twelve years of age, were formed into ten cooperative teams of two children. The children in each team were matched as to age and sex. Seven teams were boys and three were girls.[2] Selection was made via the request,

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* From N. H. Azrin, and O. R. Lindsley, The reinforcement of cooperation between children, *J. abnorm. soc. Psychol.*, **52,** 100–102 (1956). Reprinted by permission of the authors and the American Psychological Association.

[1] This paper was read at a meeting of the Eastern Psychological Association on April 10, 1954, New York City.

[2] We wish to thank the Harriet Tubman House and the South Bay Union of Boston, Mass., for providing the subjects and the use of their facilities.

"Who wants to play a game?" The first two volunteers of the same age and sex were chosen for each team. The age given by the children was verified against available community center records. No information concerning the game was given during the selection. No teams were rejected.

COOPERATIVE RESPONSE

Cooperation was assured by designing an apparatus that (*a*) could not be operated by one individual alone (assuring group behavior), and (*b*) demanded that one individual respond to the behavior of the other individual in order to produce reinforcement (assuring cooperation).

PROCEDURE

The two children of each cooperative team were placed at opposite sides of a table with three holes and a stylus in front of each child (see Fig. 1). A wire screen down the center of the table prevented each child from manipulating the other child's stylus, which was on the other side of the table.

The following instructions were given: "This is a game. You can play the game any way you want to or do anything else that you want to do. This is how the game works: Put both sticks (styli) into all three of the holes." (This sentence was repeated until both styli had been placed in the three available holes.) "While you are in this room some of these" (the experimenter (*E*) held out several jelly beans) "will drop into this cup. You can eat them here if you want to or you can take them home with you." The instructions were then repeated without reply to any questions, after which *E* said: "I am leaving the room now; you can play any game that you want to while I am gone." Then *E* left the room until the end of the experimental session.

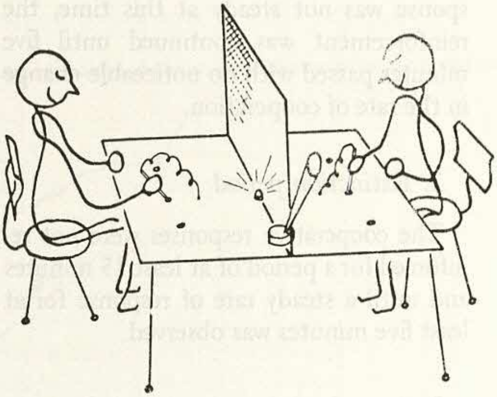

FIG. 1. Apparatus used for the reinforcement of cooperation between children. From Azrin and Lindsley: The reinforcement of cooperation between children.

If the styli were placed in opposite holes within 0.04 seconds of each other (a cooperative response), a red light flashed on the table (conditioned reinforcing stimulus) and a single jelly bean (reinforcing stimulus) fell into the cup that was accessible to both children.[3] Cooperative responses were recorded on counters and a cumulative response recorder in an adjoining room.

EXPERIMENTAL DESIGN

Each team was studied for one continuous experimental session divided into the following three consecutive periods without experimental interruption:

1. First reinforcement period

Every cooperative response was reinforced for over 15 min. If the rate of response was not steady at this time, the reinforcement was continued until five minutes passed with no noticeable change in the rate of cooperation.

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[3] Skinner (3) presented two reinforcing stimuli (one to each pigeon) following each cooperative response.

2. *Extinction period*

The cooperative responses were not reinforced for a period of at least 15 minutes and until a steady rate of response for at least five minutes was observed.

3. *Second reinforcement period*

The cooperative responses were again reinforced until at least three minutes of a stable rate occurred. This was done to determine whether a reduction in rate during the extinction period was due to extinction, satiation, or fatigue.

Results

All teams learned to cooperate without specific instructions in the first 10 min. of experimentation. Observation through a one-way vision screen disclosed that leader-follower relationships were developed and maintained in most cases. Almost immediately eight teams divided the candy in some manner. With two teams, one member at first took all the candy until the other member refused to cooperate. When verbal agreement was reached in these two teams, the members then cooperated and divided the candy. Most vocalization occurred during the initial acquisition period and throughout the extinction period. This vocalization was correlated with a higher variability in rate during these periods. (See below.)

Figure 2 contains cumulative records of the cooperative responses of the three teams with the highest, the median, and the lowest number of cooperative responses for the experimental session. These curves show a large difference in the rate of acquisition of cooperation. One team took almost 10 minutes to acquire a high cooperative response rate. Stable rates of cooperation can be observed during the latter parts of the first reinforcement period. The gradual, rather than immediate, decline in cooperation during extinction suggests an orderly extinction of cooperative behavior as is found with individual extinction curves. In all cases the variability of rate was greater during extinction than during reinforcement. Skinner has found this increased variability in rate during extinction with lower organisms and has described it as emotional behavior (2, p. 69). The high rate of response following the first reinforcement of the second reinforcement period shows that reacquisition is almost immediate.

Table 1 contains a quantification of the records for statistical analysis. The median and range of the number of cooperative responses per minute for all 10 teams during the critical periods of the experiment are given. The number of cooperative responses per minute for the first three minutes of the first reinforcement period was significantly lower than the rate during the last three minutes of the first reinforcement period ($p < .02$).[4] This shows that the rate of cooperation was significantly lower during initial acquisition than during maintenance of cooperation. The number of cooperative responses per minute during the last three minutes of extinction was significantly lower than the rate during the last three minutes of the

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[4] Wilcoxon's nonparametric *T* for paired associates was used in all statistical treatments (4).

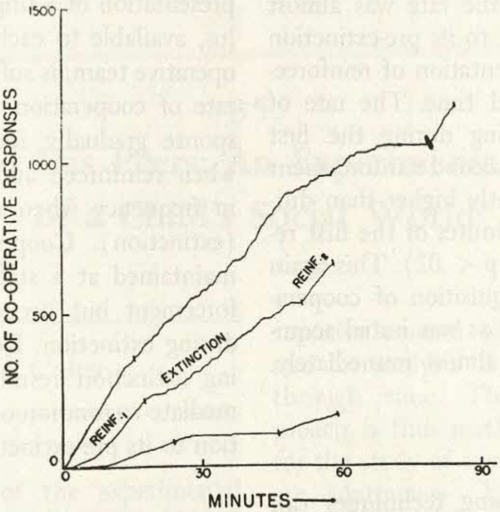

FIG. 2. Cumulative response records for the teams with the highest, median, and lowest rates of cooperation. From Azrin and Lindsley: The reinforcement of cooperation between children.

first reinforcement period ($p < .001$). This shows that the removal of reinforcement during extinction significantly lowered the rate of cooperation between these children.

The number of cooperative responses per minute during the last three minutes of the second reinforcement period was significantly above the rate during the last three minutes of the extinction period ($p < .001$). This shows that the rate of cooperation was significantly increased during the second reinforcement period and that the drop in rate during extinction was due to the absence of the reinforcing stimulus rather than satiation or fatigue. The rates of cooperation during the second reinforcement period and the last three minutes of the first reinforcement period were not significantly differ-

TABLE 1

The Median and Range of the Number of Cooperative Responses per Minute for the Critical Experimental Periods

	NUMBER OF COOPERATIVE RESPONSES PER MINUTE			
N 10	First three mins. of first reinf. period	Last three mins. of first reinf. period	Last three mins. of extinction period	Last three mins. of second reinf. period
Median	5.5	17.5	1.5	17.5
Range	1–26	6–26	0–7	6–27

From Azrin and Lindsley: The reinforcement of cooperation between children.

ent and show that the rate was almost immediately restored to its pre-extinction value upon the presentation of reinforcement for the second time. The rate of cooperative responding during the first three minutes of the second reinforcement period was significantly higher than during the first three minutes of the first reinforcement period ($p < .02$). This again shows that the reacquisition of cooperation was not gradual, as was initial acquisition, but occurred almost immediately.

Conclusions

Operant conditioning techniques can be used to develop, maintain, and eliminate cooperation between children without the use of specific instructions concerning cooperation. The rate of a cooperative response changes in much the same way as a function of single reinforcements as does an individual response. In the reinforcement of cooperative responses, a reinforcing stimulus need not be delivered to each member of the cooperative team following each cooperative response. The presentation of a single reinforcing stimulus, available to each member of the cooperative team, is sufficient to increase the rate of cooperation. The cooperative response gradually increases in frequency when reinforced and gradually decreases in frequency when no longer reinforced (extinction). Cooperative responses are maintained at a stable rate during reinforcement but occur in sporadic bursts during extinction. Reinforcement following extinction results in an almost immediate restoration of the rate of cooperation to its pre-extinction value.

REFERENCES

1. Peters, H. N., & Murphree, O. D. A cooperative multiple-choice apparatus. *Science*, 1954, **119**, 189–191.
2. Skinner, B. F. *Science and human behavior.* New York: Macmillan, 1953.
3. Skinner, B. F. Classroom demonstration. Personal communication, 1952.
4. Wilcoxon, F. *Some rapid approximate statistical procedures.* New York: American Cyanamid Co., 1949.

35.

Justin and His Peers: An Experimental Analysis of a Child's Social World*[1,2]

Donald J. Cohen

The techniques of the experimental analysis of individual behavior developed in the researches of Pavlov, Watson, and Skinner have only recently been extended to human activities involving more than one person (2; 8, ch. 19). The methods of free operant conditioning allow for a sensitive control of particular variables and for analysis of changes in behavior through time. This experimental approach is thus methodologically suitable for the study of social transactions which are continuous (1, pp. 112–117) and which can be shown to be related to particular classes of environmental events. While interviewing and questionnaire techniques can be used to obtain data on retrospective reports of behavior and attitudes or dispositions, the free operant method can be used in the analysis of ongoing behavior and the changes in behavior which occur when people confront each other in a social situation. Also, while field observation is usually inexact and open to observer bias, the free operant method allows for scientific control and precision in response definition and measurement.

The first free operant experimental analysis of human social behavior (2) demonstrated the possibility of generating cooperative behavior in young children through the scheduling of candy reinforcements. The cooperative behavior could be extinguished by withholding the reinforcements and regenerated through the rescheduling of the reinforcements.

In this present paper, a new instrument for the experimental analysis of social behavior is briefly described. The results of analysis of the social behavior of a par-

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* From D. J. Cohen, Justin and his peers: an experimental analysis of a child's social world, *Child Developm.*, **33**, 697–717 (1962). Reprinted by permission of the author and the Society for Research in Child Development.

[1] Dr. Ogden R. Lindsley, Director of the Behavior Research Laboratory, has influenced this research and shaped the behavior of the author in more ways than can possibly be enumerated. The interest Dr. Lindsley has shown, the guidance and criticism he has afforded, and the freedom he has allowed go far beyond that which any student has the right to expect.

[2] The research was conducted at the Behavior Research Laboratory, Metropolitan State Hospital, Waltham, Massachusetts. The experiments were supported by a special research grant from Brandeis University and Research Grant NSF G-9516 from the Division of Social Sciences, National Science Foundation.

ticular young person are discussed. These results demonstrate that the young man behaves differently towards people with whom he has different nonexperimentally determined relations. Nonexperimental observations of the social behavior of the subjects support the clinical validity of the experimental findings.

Method

SUBJECTS[3]

The social behavior of Justin, a normal 13-year-old, is studied in relation to people with whom he has different relationships. The five people involved in this analysis of Justin's social profile are his brother (age 16), sister (age 14), close friend (age 13), mother, and a stranger (age 14).

APPARATUS

The experimental environment employed throughout the experiments was two adjacent 6-ft. square rooms. Each room was equipped with a standard operant conditioning panel on one wall (Figure 1) as described by Lindsley (6). Mounted on each panel was a metal plunger; the plunger could be pulled with little effort and in some experiments has been pulled up to several thousand times within 90 minutes with no signs of fatigue. Located on each panel was a small bin into which the reinforcements (pennies and candy) were dropped. The two adjacent rooms were separated by a clear plexiglass window through which the subjects could see each other when seated in front of the operant panels. . . .

Controlling and recording apparatus was located behind the experimental rooms in an adjoining area from which the experimental rooms were observed through concealed periscopes. A white noise generator delivered covering noise to concealed speakers in each room. The noise was maintained just loud enough to prevent any discussion between the subjects.

RESPONSE DEFINITION

There are two major response definition categories: team responses and individual responses (Figure 1). The latter involves only one subject, the former requires the participation of both. All response categorization was performed automatically by switching circuits. As individual *A* pulled his plunger, an impulse shortener converted the movement into an electric impulse of .06 sec. duration. Similarly, *B*'s response was converted into an electric impulse. The impulses were fed into a sequence analyzer which categorized the responses into four groups: *A* followed by *B* (AB); *B* followed by *A* (BA); *A* followed by *A* (AA); *B* followed by *B* (BB). AB and BA were team responses; AA and BB were individual responses.

In order to facilitate the study of socially defined, or team, behavior, the individual responses were mildly punished. The punishment for an AA consisted of *A*'s room being darkened for 2.5 sec. during which a pure tone (500 cycles) was sounded through his speaker (see [5, p. 35]). When either *A* or *B* was being blacked out, no responses entered the sequence analyzer.

The team responses are further defined

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[3] The kind of cooperation of the Sisters of the St. Joseph's School, Waltham, Massachusetts, the students, and the parents who allowed their children to behave is greatly appreciated.

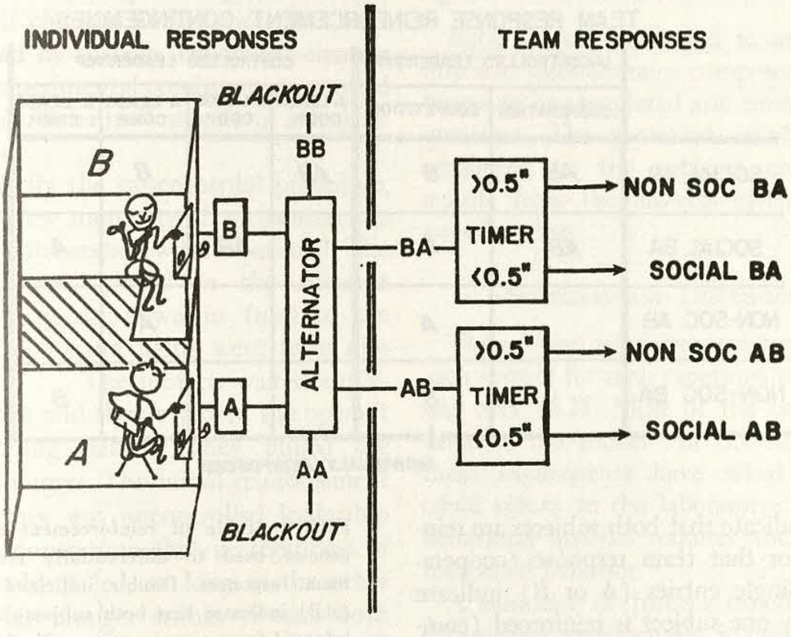

FIG. 1. Schematic drawing of apparatus and response definition for individual and team responses. Each room is equipped with a metal plunger; movement of the plunger produces an electric impulse which is electrically defined into individual and team responses as shown in the block diagram. From Cohen: Justin and his peers: an experimental analysis of a child's social world.

on the basis of the temporal relationship between the two responses. An *A* response followed within .5 sec. by a *B* response is a *Social AB*. An *A* response followed within any period of time greater than .5 sec. is a *Nonsocial AB*. *Social BA* and *Nonsocial BA* responses are defined analogously. The value of .5 sec. was chosen on the basis of exploratory investigation. The probability that a second response would follow the first within .5 sec. by chance alone (and without the production of AA or BB responses) was found to be slight. Team and individual responses of each category were simultaneously recorded on separate cumulative recorders and digital counters. The cumulative records provide a continuous measure of the ongoing social behavior throughout an experimental session.

Reinforcement Contingencies

Cooperation is operationally defined in this study as behavior in which both subjects are involved and in which both are reinforced. Competition is defined as behavior in which both subjects are involved and only one is reinforced. That is, cooperation and competition are team responses which are differentiated on the basis of the reinforcement, or "pay-off," contingency. The horizontal rows of Figure 2 list the four team responses that are differentially reinforced; the columns are the type of social behavior that is defined by the programmed reinforcement contingency. The italicized letters in the squares specify who is reinforced for each particular team response. Double entries

TEAM RESPONSE REINFORCEMENT CONTINGENCIES

	UNCONTROLLED LEADERSHIP		CONTROLLED LEADERSHIP			
	COOPERATION	COMPETITION	A LEADS COOP.	B LEADS COOP.	A LEADS COMP.	B LEADS COMP.
SOCIAL AB	*AB*	*B*	*AB*		*B*	
SOCIAL BA	*AB*	*A*		*AB*		*A*
NON-SOC AB		*A*			*A*	
NON-SOC BA		*B*				*B*

↑ *INDIVIDUALS REINFORCED*

FIG. 2. Table of reinforcement contingencies used to differentially reinforce team responses. Double italicized entry (*AB*) indicates that both subjects are reinforced for a team response. Single italicized entry (*A* or *B*) indicates which single subject is reinforced for a team response. An empty square indicates that the team response is programmed for extinction. [The controlled leadership condition required that a particular subject lead; the uncontrolled condition did not.] From Cohen: Justin and his peers: an experimental analysis of a child's social world.

(*AB*) indicate that both subjects are reinforced for that team response (cooperation). Single entries (*A* or *B*) indicate that only one subject is reinforced (competition). Empty squares indicate that no reinforcement is delivered for that team response (extinction). Individual responses (AA and BB) are never positively reinforced. [Uncontrolled leadership refers to the case where reinforcement was delivered regardless of which subject (*A* or *B*) led. Controlled leadership required that the team response be made in a particular order.] . . .

The schedule of reinforcement was continuous (crf): for every reinforced team response a penny or piece of candy dropped into either one or both reinforcement bins on the operant panels (*see* [3]). Punishment was also on a continuous (crf) schedule: for every punished individual response (AA or BB) the punished subject (*A* or *B*) was blacked out as described above.

Reinforcement consisted of a mixture of pennies and candy in an approximate ratio of four pennies to one candy (an assortment of gumdrops, pieces of chocolate, and other small candies).

Experimental Situation

The two subjects were brought to the laboratory together by the experimenter. They were given a minimal amount of information concerning what was to take place, with instructions limited to the following: "You are going to play a game. You can keep all you get." The subjects were then placed in the adjoining rooms in which the lights were dimmed. No other information was given the subjects at any time during the experimental session. All changes in behavior thus were generated by specific, controlled changes in the experimental conditions or resulted from the "dynamic" aspects of social interaction.

To clarify the experimental procedure, the first few moments of a *characteristic* experimental session will be outlined. The subjects were placed in the adjacent rooms; they sat down in front of the panels. The room lights went from dim to bright. . . . The subjects waited a minute or two and then explored the operant conditioning panels. They pulled the metal plungers. The initial reinforcement contingency was uncontrolled leadership during cooperation; that is, regardless of which subject led, so long as the other pulled his plunger within .5 sec., both were reinforced. *A* pulled his plunger; *B* pulled his within .5 sec. This constitutes a Social AB response. The room lights dimmed and a light went on in the reinforcement bin on each panel (conditioned reinforcer). A penny (reinforcement) fell into the reinforcement bin in each room and the lights remained dim for 5 sec. (the conditioned reinforcement cycle). The room lights brightened. *B* pulled his plunger and *A* followed within .5 sec. This is a Social BA. The rooms were dimmed and a reinforcement delivered to each bin. When the lights brightened again, *B* pulled his plunger twice in a row (BB). A sequence of two responses by the same subject (individual responding) was mildly punished. *B*'s room darkened while a pure tone was delivered to his speaker for 2.5 sec. (black out B). When the lights went on again, either *A* or *B* could have led, and, so long as the other followed within .5 sec., both were reinforced by a penny dropping into both bins. . . .

Questionnaire Results: Brief Survey

Each subject was asked to answer an informal questionnaire composed of sentences to be completed and several direct questions. The quotations in this paper attributed to the subjects are drawn mainly from the answers given to this questionnaire. . . .

Summary and Discussion

The average reinforcement received by each subject for each experimental session was over $6.25. Most of the candy was eaten in the rooms. All the subjects in these experiments have asked if they could return to the laboratory. Sensitive behavioral analysis requires such highly motivated behavior.

A summary of Justin's experimentally determined social profile is presented in Table 1. A synopsis of the social behavior of the five teams in four different reinforcement contingencies (*see* Figure 3) demonstrates the differences in Justin's social behavior in each team.

Justin led those people with whom he had previous nonexperimental experience of leadership, his brother and his friend. His sister who "mothers" him and his mother look strikingly similar during cooperation: both were strong leaders during uncontrolled leadership and both exhibited resistance to following him by bursts of inappropriate leadership responding when they were not reinforced for leading. With Justin and the friend, the stranger, and his mother, the competitive contingency was converted into complex cooperation. Justin and his sister displayed strong competition.

Justin has occupied more of his parents' attention than any of the other six children in the family, and the results of this family situation are reflected in the experi-

TABLE 1

Justin's Social Profile

TEAM	UNCONTROLLED LEADERSHIP	CONTROLLED LEADERSHIP		UNCONTROLLED COMPETITION
Justin and . . .		*Justin's lead reinforced*	*Other's lead reinforced*	
Brother	Justin leads. Long acquisition. Individual responses.	Long acquisition. Brother persists in leading.	Shorter acquisition. Justin slow to follow.	
Friend	Justin leads; halts friend's attempts to lead.	Rapid acquisition.	Rapid acquisition. Justin slow to follow.	Alternation of leadership.
Stranger	Stranger leads strongly.			Unstable competition becomes alternation of leadership.
Sister	Sister leads strongly.	Rapid acquisition. Bursts of sister responding.		Competition.
Mother	Mother leads strongly.	Rapid acquisition. Bursts of mother responding.	Rapid acquisition.	Alternation of leadership.

Note. No entry—condition not used. From Cohen: Justin and his peers: an experimental analysis of a child's social world.

mental analysis. Both his older brother and his immediately younger sister (age 12, not used in this experiment) have had psychiatric treatment for behavioral problems. The 12-year-old sister suffered from trichotillomania but is now recovered; his older brother still shows signs of [earlier behavior problems] Justin's older sister (age 14) manifests her envy and aggression by "mothering" him; his older brother manifests his by trying to underrate Justin's accomplishments and by trying to prevent further achievement. These Justin-sister and Justin-brother interactions are evidenced in the experimental analysis by the slow development of cooperation and control of leadership (Justin-brother) and the strong leadership accompanied by true competition (Justin-sister). The experimental analysis is validated by such statements as Justin's mother's in relation to her children: "They are the most competitive, aggressive group you ever met." The experimental analysis has successfully evaluated the type of expression given the "competitive, aggressive" family spirit.

Justin and his friend had a long history of extra-experimental cooperation. Their experimental behavior is fully cooperative with immediate alternation of leadership during programmed competition. Justin and the stranger had no history of extra-experimental cooperation; after initial competition during programmed competition, their experimental behavior changed into the more complex form of cooperation. Justin and his brother had a long history of competition and aggression; their experimental behavior is marked by a large number of nonteam responses, long periods of acquisition, persistence of nonreinforced leading, and the other occurrences noted above.

The results of these experiments clearly demonstrate that Justin's social behavior is differentially controlled by reinforcement. However, the dynamic properties of his social behavior are controlled by his previous extra-experimental relations with his teammates. Different patterns with different teammates prove that the method is sensitive to different social relationships. Further, the results of the experimental analysis are validated by the information gathered from the questionnaires and interviews. The experimental analysis, [however], indicates that the actual social behavior of an individual may contradict the statements made by that person concerning the social transaction (e.g., Justin and his mother).

The experimental analysis adds definiteness and precision to the non-experimental information concerning the subject's social interactions. Also, it is possible to further refine the type of behavior engaged in by the subjects as manifestations of such clinically relevant concepts as aggression, competition, unwillingness to follow, etc. For example, an analysis of unwillingness to follow has shown that it is expressed in both (a) leading when not being reinforced for leading and (b) hesitancy to respond after the leader has responded. Both (a) and (b) are manifested in the same experimental social circumstances by different individuals. . . .

Conclusions

The experimental determination of five different dynamic patterns of cooperative and competitive leadership between a young man and five other persons clearly demonstrates the sensitivity of this free operant method to important social variables. The close similarity between the experimentally measured patterns and the extra-experimental relationships as determined by questionnaires and interviews demonstrates that these experimental measures have high validity. The method permits a laboratory analysis of a child's social world.

REFERENCES

1. Argyle, M. *The scientific study of social behavior.* London: Methuen, 1957.

2. Azrin, N. H., & Lindsley, O. R. The reinforcement of cooperation between children. *J. abnorm. soc. Psychol.*, 1956, **52,** 100–102.

3. Bijou, S. W. Patterns of reinforcement and resistance to extinction in young children. *Child Developm.*, 1957, **28,** 47–54.

5. Ferster, C. B., & Skinner, B. F. *Schedules of reinforcement.* Appleton-Century-Crofts, 1957.

6. Lindsley, O. R. Operant conditioning methods applied to research in chronic schizophrenia. *Psychiat. Res. Rep.*, 1956, **5,** 118–139.

8. Skinner, B. F. Science *and human behavior.* Macmillan, 1953.

36.

The Formation of Positive Attitudes Toward Group Members*[1]

Bernice Eisman Lott and
Albert J. Lott

In an attempt to predict group behavior on the basis of general psychological principles as contrasted with formulations specific to the area, the concept of group cohesiveness has been re-examined and reformulated within a learning theory framework (Lott, in press). Within this framework, cohesiveness is defined as *that group property which is inferred from the number and strength of mutual positive attitudes among the members of a group.* The concept of attitude is used, instead of the more usual one of attraction, because of its precise and particular meaning within learning theory, i.e., an implicit anticipatory response having cue and drive properties (Doob, 1947). By defining cohesiveness in terms of mutual positive attitudes among group members, the assumption is made that the members who comprise a group constitute its most significant components.

A number of hypotheses regarding both the antecedents and consequents of cohesiveness, as defined above, have been derived from learning theory (Lott, in press). The problem of this experiment has been to test the most fundamental of these hypotheses, one which concerns the conditions under which positive attitudes toward group members may be formed.

It is predicted that if a person is rewarded in the presence of others (fellow group members), he will develop positive attitudes toward them. This proposition rests upon the following assumptions:

1. Persons may be conceptualized as discriminable stimuli to which responses may be learned.

2. A person who experiences reinforcement or reward for some behavior will react to the reward, i.e., will perform some observable or covert goal response (R_g or r_g).

3. This response to reward will become conditioned, like any other response, to all discriminable stimuli present at the time of reinforcement.

4. A person (group member) who is present at the time that Individual X, for example, is rewarded thus becomes able, in a later situation, to evoke R_g or, what

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* From B. E. Lott and A. J. Lott, The formation of positive attitudes toward group members, *J. abnorm. soc. Psychol.*, **61,** 297–300 (1960). Reprinted by permission of the authors and the American Psychological Association.

[1] A paper, based on this investigation, was read at the 1959 American Psychological Association meetings in Cincinnati.

is more likely, its fractional and anticipatory component, $r_g - s_g$. This latter response, which Hull has called "expectative" (1952, Ch. 5), was earlier interpreted by Doob (1947) as the underlying mechanism of an attitude.

The specific prediction tested by this study is that members of three-person groups who are rewarded for their performance in the presence of their fellow group members will more likely develop positive attitudes toward them than will members of such groups who are not rewarded. Positive attitudes are inferred, here, from choices made on a sociometric test subsequent to, and outside of, the experimental situation.

Method

SUBJECTS

Forty-eight children from the University of Kentucky Elementary School, 24 each from Grades 3 and 5, served as Ss.[2]

PROCEDURE

The Ss were divided into 16 three-member groups, following the administration of two sociometric tests. These tests were given, by the regular classroom teachers, on two consecutive days, several days before the actual experimental situation. On the basis of the test results the groups were formed so that each group was made up of children who had *not chosen each other* on either of the tests. Four all male and four all female groups were formed from Grade 3; five male and three female groups were formed from Grade 5.

Omitting the preliminary instructions, the criterion question asked in the first test was as follows:

> *Test I.* Let us suppose that each one of you gets picked to take a trip to the moon in a rocket ship. This is a very special trip. . . . It is important for everyone who is on the same ship to get along well with each other. . . . Because of this you get a chance to pick two children to go along with you. Now, of all the children in this class, which two would you pick to travel in the same rocket ship with you?
>
> *Test II.* [For this test the children were asked to think of themselves as visitors from Mars and to choose two classmates whom they would like to have waiting for them when their spaceship landed on Earth.]

For a group situation in which rewards and nonrewards could be manipulated, a board game called "Rocket Ship" was devised. The object of the game, played by groups of three, is to land cardboard rocket ships on planetary objectives. Each objective is reached by traversing a separate path containing four danger zones, at each of which a choice between a white and a striped subpath (one "safe" and the other "dangerous") must be made. By having the children in a group take turns crossing the danger zones first, the *Es* could arrange to have some children succeed and others fail in reaching the planets safely. The manner in which this was accomplished will be described below.

On the day of the experiment proper

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[2] The authors wish to acknowledge the cooperation of the following persons whose kind assistance made possible both the reported experiment and the pilot work which preceded it: M. Hitch, Principal of Rosenwald Laboratory School, Frankfort, Kentucky; A. Wolfe, intermediate grade teacher at Rosenwald; E. Sasman, Principal of University Elementary School, Lexington, Kentucky; A. Boone, M. Moore, and O. Barrett, teachers at University School of the third, fourth, and fifth grades, respectively.

(separate days for the two classes), the *E*s were introduced to *S*s as having developed a children's game which they wished to test. One group at a time was called upon (in a predetermined random order) to play the game in a room adjoining the regular classroom.[3] The following instructions, given to each group by one of the investigators (E_1), describe the manner of playing:

> . . . You three are rocket ship pilots. Each one of you has your own ship but you are going to take a trip into outer space together, side by side. The first trip you are going to take is to ——. In order to get there you must follow this path which scientists have decided is the safest way to go. The scientists also know that, at a few points along the way on this path, there is great danger. When you get to one of these dangerous points you are going to have to stop and decide whether the striped path or the white path is the dangerous one. One of the paths will get you past the danger safely. If you take the wrong path your rocket ship will be blown up and you'll have to parachute to Earth. . . . When you get to a danger point you'll have to decide which one of the group will take a chance and be the first to try either the striped or white path. If he gets through safely, the other two rockets may follow him. If his ship should get blown up, though, the other two ships will take the other path which you will know to be safe. You'll know that a ship has been blown up when you hear the sound of a bell, like this [sounded by E_2]. . . . Remember, you must take turns being first.
>
> . . . It's possible for all three of you to get through to a planet safely, but it may be that only two of you will make it, and maybe just one or none of you will make it. . . . If you reach a planet safely you will be able to choose one of these prizes [small plastic auto models] which you may keep. . . . We'll play half the game this morning and half this afternoon.

Each group tried for three objectives in the morning and three in the afternoon. Half the total number of *S*s was permitted to land safely on four planets (two at each session) while half was prevented from reaching any of them. "Reward" was thus defined as the receipt of four plastic car models (one for each successful landing). A child was either "rewarded" or "not-rewarded," i.e., made no successful landings at all and received no prizes; there were no in-between conditions. Prizes won in the morning session were held by the *E*s until the end of the afternoon session at which time the rewarded *S*s returned to their classroom with four model cars and the nonrewarded *S*s returned with none.

Rewarded and nonrewarded *S*s were selected on a random basis prior to the game. A nonrewarded *S* always had his ship "blown up" when, at his chance to go first at a danger point, he took either the striped or white path.[4] As soon as he made his choice of path, the "blow up" bell was rung by E_2 who sat somewhat apart from the game area.

Each group had been randomly assigned, prior to the game situation, to one of the following conditions which describe the number of group members who were to be rewarded during the game: zero, one, two, all. Four groups, two from each class, were assigned to each condition. This aspect of the design was introduced to avoid having the Ss suspect that the game was "rigged." The natural flavor of the game was maintained by having Ss know that it was possible for all three group members to be successful, or only two, etc.

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[3] Wherever a child, preselected for a particular group, was absent on the day of the experiment, a substitute who met the criterion of nonchoice by, and of, the other group members, was, in all cases, available.

[4] Each child was in the position of "being first" at a danger point at least once on his way to each of the planets since *S*s had been instructed to take turns and there were four danger zones per path and three children in a group. It was always possible, therefore, to "blow up" nonrewarded *S*s without interfering with a group's spontaneous behavior regarding which child would go first at which point.

Shortly before the close of the school day, approximately one hour after the last group had played the game, the classroom teacher administered another sociometric test (III), as follows:

> Suppose your family suddenly got the chance to spend your next vacation on a nearby star out in space . . . you can invite two children to go on the trip . . . and spend the holiday with you on the star. Which two children in this class would you choose to take with you?

After the choices were collected by the teacher, E_2 appeared before the class to thank the Ss for their cooperation and help. And, because everyone had been such "good sports," four prizes were distributed to each of the youngsters who had not won them during the game.

Results

The results of the final sociometric test (III), which succeeded the play-group experience, are presented in Table 1. The proportion of play-group members chosen by rewarded Ss was found to be significantly greater than the proportion chosen by nonrewarded Ss. The obtained critical ratio, corrected for continuity, is 2.14 ($p = .03$; two-tailed). This confirms the prediction that Ss who had been rewarded would choose members of their groups, on the final sociometric test, significantly more often than Ss who had not been rewarded.

DISCUSSION

The present findings indicate that the formation of positive attitudes toward persons is predictable from learning theory principles and can be studied in the laboratory. This study thus extends the applicability of a general S-R framework to significant social behavior.

TABLE 1

Choices Made by Subjects on Sociometric Test III

Subjects	CHOICES play-group member	 Non-play-group member	N^a
Rewarded	11	37	48
Nonrewarded	3	45	48

^{a} N = number of choices made; each S made two choices.

From Lott and Lott: The formation of positive attitudes toward group members.

The prediction that positive attitudes toward persons can be formed by experiencing reward in their presence, was clearly confirmed. Since it is in terms of such positive attitudes among the members of a group that cohesiveness has been defined, the present experiment is seen to be concerned with the antecedents or determinants of cohesiveness even though no attempt was made to measure the variable directly. The specific concern of this first study was with the development of positive attitudes toward group members and not with the group property that results from such attitudes when they are mutual.[5]

There have been comparatively few experimental attempts to vary group cohesiveness other than by suggesting to the members of a group that they will like each other. One investigation in which determinants were experimentally manipulated (Thibaut, 1950) found a positive relationship between cohesiveness and group status. In another study, more relevant to the present one (Bovard, 1951), a significantly greater level of interpersonal affect was found in group-centered as compared with traditional leader-centered classes. Bovard suggested that this result was due to the fostering, in group-centered classes, of member-to-member interaction which produces greater accuracy in intermember perception, creating, according to Bovard, a situation conducive to "need satisfaction." That the experience of need satisfaction (reward) in the presence of group members can, indeed, result in positive affect toward those group members has been demonstrated in the present experiment.

The results obtained in this study should be evaluated in the light of the following factors which could only have tended to work against substantiation of the hypothesis:

1. Play-group members were, by design, neutral or negative stimuli for one another at the beginning of the experimental situation. This was assured by placing, in a group, only Ss who had not chosen one another on two previous sociometric tests.
2. The amount of reward experience received by rewarded Ss in the presence of others was extremely small when compared with the amount of daily contact our Ss typically had with each other in the classroom, playground, and after school. (Practically all the Ss in each of the classes had been together for their entire schooling, beginning with kindergarten.)
3. The choices made on the two pre-experimental sociometric tests (I and II) were found to be unexpectedly stable for third and fifth graders, indicating relatively reliable friendship ties[6] which the experimental experience was able to disrupt, however temporarily.[7]

Despite the above factors the prediction, that positive attitudes toward persons will be developed as a result of the receipt of reward in their presence, was clearly supported. Though the results were obtained with children, there is no reason to expect that they would not hold with adults as well. Such generalization must, of course, await adequate test.

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[5] An operational measure of cohesiveness which follows directly from the definition of the concept given earlier has been developed by the investigators and will be reported in connection with its use in another study.

[6] Forty percent of the Ss made the same two choices on both tests; another 42% of the Ss repeated one choice on both tests.

[7] No follow-up test was given since there was no reason to expect that the positive attitudes formed during the brief game situation would last, in the absence of continued reward experience in the presence of the same individuals.

The variable manipulated in the present study was simply reward vs. nonreward. Future research might profitably deal with variations in reward frequency, delay, and schedule, for example, as these affect the conditioning of attitudinal responses, and, consequently, as these affect the development of cohesiveness in small groups. That the results obtained in this study were predicted from general behavior principles increases our confidence in the promise which this kind of an approach holds for the general area of small group behavior.

SUMMARY

Three-member groups of children played a game in which some members were rewarded and others were not. On a later sociometric test, outside of the game situation, rewarded Ss chose a significantly greater proportion of their fellow group members than did the nonrewarded Ss. These results were predicted from general principles of S-R learning theory.

REFERENCES

Bovard, E. W. The experimental production of interpersonal affect. *J. abnorm. soc. Psychol.*, 1951, **46**, 521–528.

Doob, L. W. The behavior of attitudes. *Psychol. Rev.*, 1947, **54**, 135–156.

Hull, C. L. *A behavior system*. New Haven: Yale Univer. Press, 1952.

Lott, Bernice E. Group cohesiveness: A learning phenomenon. *J. soc. Psychol.*, 1961, **55**, 275–286.

Thibaut, J. An experimental study of the cohesiveness of underprivileged groups. *Hum. Relat.*, 1950, **3**, 251–278.

37.

A Comparative Test of the Status Envy, Social Power, and the Secondary Reinforcement Theories of Identification Learning*[1]

Albert Bandura, Dorothea Ross,[2]
and Sheila Ross

Although it is generally assumed that social behavior is learned and modified through direct reward and punishment of instrumental responses, informal observation and laboratory study of the social learning process reveal that new responses may be rapidly acquired and existing behavioral repertoires may be considerably changed as a function of observing the behavior and attitudes exhibited by models (Bandura, 1962).

The latter type of learning is generally labeled "imitation" in behavior theory, and "identification" in most theories of personality. These concepts, however, are treated in the present paper as synonymous since both encompass the same behavioral phenomenon, i.e., the tendency for a person to match the behavior, attitudes, or emotional reactions as exhibited by actual or symbolized models. While the defining properties of identification are essentially the same in different personality theories, a host of divergent learning conditions have been proposed as the necessary antecedent variables for matching or identificatory behavior (Bronfenbrenner, 1960; Freud, 1946; Freud, 1924, 1948; Kagan, 1958; Klein, 1949; Maccoby, 1959; Mowrer, 1950; Parsons, 1955; Sears, 1957; Whiting, 1960).

In the experiment reported in this paper predictions were derived from three of the more prominent theories of learning by identification, and tested in three-person groups representing prototypes of the nuclear family. In one condition of the experiment an adult assumed the role

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* From A. Bandura, D. Ross, and S. A. Ross, A comparative test of the status envy, social power, and the secondary reinforcement theories of identification learning, *J. abnorm. soc. Psychol.*, **67**, 527–534 (1963). Reprinted by permission of the authors and the American Psychological Association.

[1] This investigation was supported by Research Grant M-5162 from the National Institutes of Health, United States Public Health Service.

The authors are indebted to Beverly Busching, Malka Yaari, Nancy Wiggins, and John Steinbruner, who assisted in collecting the data.

[2] This research was carried out while the junior author was the recipient of an American Association of University Women International Fellowship for post-doctoral research.

of controller of resources and positive reinforcers. Another adult was the consumer or recipient of these resources, while the child, a participant observer in the triad, was essentially ignored. In a second treatment condition, one adult controlled the resources; the child, however, was the recipient of the positive reinforcers and the other adult was assigned a subordinate and powerless role. An adult male and female served as models in each of the triads. For half the boys and girls in each condition the male model controlled and dispensed the rewarding resources, simulating the husband dominant family; for the remaining children, the female model mediated the positive resources as in the wife dominant home. Following the experimental social interactions the two adult models exhibited divergent patterns of behavior in the presence of the child, and a measure was obtained of the degree to which the child subsequently patterned his behavior after that of the models.

According to the *status envy theory* of identification recently proposed by Whiting (1959, 1960), where a child competes unsuccessfully with an adult for affection, attention, food, and care, the child will envy the consumer adult and consequently identify with him. Whiting's theory represents an extension of the Freudian defensive identification hypothesis that identificatory behavior is the outcome of rivalrous interaction between the child and the parent who occupies an envied consumer status. While Freud presents the child as in competition with the father primarily for the mother's sexual and affectional attention, Whiting regards any forms of reward, material and social, as valued resources around which rivalry may develop. The status envy theory thus predicts that the highest degree of imitation by the child will occur in the experimental condition in which the rivalrous adult consumes the resources desired by the child, with the consumer adult serving as the primary object of imitation.

In contrast to the envy theory, other writers (Maccoby, 1959; Mussen & Distler, 1959; Parsons, 1955) assume that the controller, rather than the consumer, of resources is the main source of imitative behavior. The *power theory* of social influence has received considerable attention in experimental social psychology, though not generally in the context of identification theories.

Social power is typically defined as the ability of a person to influence the behavior of others by controlling or mediating their positive and negative reinforcements. French and Raven (1959) have distinguished five types of power based on expertness, attractiveness, legitimacy, coerciveness, and rewarding power, each of which is believed to have somewhat differential effects on the social influence process. For example, the use of threat or coercion, in which the controller derives power from his ability to administer punishments, not only develops avoidance behavior toward the controller but also decreases his attractiveness and hence his effectiveness in altering the behavior of others beyond the immediate social influence setting (French, Morrison, & Levinger, 1960; Zipf, 1960). The use of reward power, in contrast, both fosters approach responses toward the power figure and increases his attractiveness or secondary reward value through the repeated association of his attributes with positive reinforcement. Attractiveness is assumed to extend the controller's power over a wide range of behavior (French & Raven, 1959).

In the present investigation power based upon the ability to dispense rewards was manipulated experimentally. In accordance with the social power theory of identification, but contrasting with the status envy hypothesis, one would predict that children will reproduce more of the behavior of the adult who controls positive reinforcers, than that of the powerless adult model, and that power inversions on the part of the male and female models will produce cross-sex imitation.

The *secondary reinforcement theory* of identification, which has been alluded to in the discussion of social power through attractiveness, has been elaborated in greatest detail by Mowrer (1950, 1958). According to this view, as a model mediates the child's biological and social rewards, the behavioral attributes of the model are paired repeatedly with positive reinforcement and thus acquire secondary reward value. On the basis of stimulus generalization, responses which match those of the model attain reinforcing value for the child in proportion to their similarity to those made by the model. Consequently, the child can administer positively conditioned reinforcers to himself simply by reproducing as closely as possible the model's positively valenced behavior. This theory predicts that the experimental condition in which the child was the recipient of positive reinforcements will yield the highest imitation scores with the model who dispensed the rewards serving as the primary source of imitative behavior.

Method

SUBJECTS

The subjects were 36 boys and 36 girls enrolled in the Stanford University Nursery School. They ranged in age from 33 to 65 months, although the variability was relatively small with most of the ages falling around the mean of 51 months.

An adult male and female served as models in the triads so as to reproduce possible power structures encountered in different types of family constellations. A female experimenter conducted the study for all 72 children.

DESIGN AND PROCEDURE

The subjects were assigned randomly to two experimental groups and one control group of 24 subjects each. Half the subjects in each group were males, and half were females.

High rewarding power was induced experimentally through the manipulation of material and social reinforcements, and the use of verbal structuring techniques. While accompanying the child to the experimental room, for example, the experimenter informed the child that the adult who assumed the role of controller owned the nursery school "surprise room," as well as a fabulous collection of play materials. After introducing the child to the controller, the experimenter asked whether the child may play in the surprise room. The controller explained that he was on his way to his car to fetch some of his most attractive toys, but the experimenter and the child could proceed to the room where he would join them shortly. As the controller left, the experimenter commented on how lucky they were to have access to the controller's play materials.

On the way to the experimental room they met the other adult who insisted on joining them but the experimenter informed her that she would have to obtain permission from the controller since he owned the room, and it was doubtful whether sufficient play materials were available for both the adult and the child. This brief encounter with the other adult was designed primarily to create the set that rewards were available to one person only and thereby to induce rivalrous feelings over the controller's resources.

As soon as the experimenter and the child arrived in the experimental room, they sat down at a small table and played with the few Lincoln Logs and two small cars that were provided. A short time later the other adult appeared and announced that the controller also granted her permission to play in the room.

The controller then entered carrying two large toy boxes containing a variety of highly attractive masculine and feminine toys, a colorful juice dispensing fountain, and an ample supply of cookies. As soon as the controller appeared on the scene, the experimenter departed.

For children in the Adult Consumer condition, the adult who assumed the role of consumer requested permission to play with the articles and the controller replied that, since the child appeared to be occupied at his table, the consumer was free to use the play materials. This monopolistic move by the consumer adult left the child stranded at a table with two relatively uninteresting toys.

During the 20-minute play session, the controller offered the consumer, among other things, miniature pinball machines, mechanical sparkling toys, kaleidoscopes, dolls, and actively participated with the consumer in dart games and other activities. To add to the credibility of the situation, both the controller and consumer devoted most of their attention to articles, such as the pinball machine and dart game, which could be used in adult appropriate activities. Throughout the interaction the controller was most helpful, supportive, and generous in dispensing social reinforcers in the form of praise, approval, and positive attention. The consumer, in turn, commented frequently on the controller's highly attractive resources so as to further enhance the controller's rewarding status. The consumer also verbalized considerable positive affect characteristic of a person experiencing positive reinforcements.

Approximately half way through the session, the controller remarked, "Say, you look hungry. I have just the thing for you." He then brought forth the soda fountain dispenser, poured colorful fruit juices into paper cups and served them to the consumer along with a generous supply of cookies. While the consumer was enjoying his snack, the controller turned on a "TV-radio" that played a nursery melody while a revolving dial displayed a series of storybook scenes.

Toward the end of the session, the controller informed the consumer that he will be leaving on a shopping trip to San Francisco that afternoon, and asked the consumer if there was anything special she would like him to buy for her. The consumer requested a super two-wheel bicycle, a high status object among the nursery school children. The controller promised to purchase the bicycle along with any other items the consumer might think of before the controller departed for the city.

The procedure for the Child Consumer condition was identical with that described above except the child was the recipient of the material rewards and the social reinforcement. During the session the other adult sat at the opposite end of the room engrossed in a book, and was totally ignored by the controller. In discussing the prospective San Francisco shopping trip, the controller mentioned to the child that he was planning to visit some toy stores in the city that afternoon, and asked for suggestions of attractive toys he might purchase for future play sessions with children.

For half the boys and girls in each treatment condition the male model controlled and dispensed the resources, simulating the husband dominant family; for the remaining children the female model mediated the positive resources as in the wife dominant home.

At the completion of the social interaction session the controller announced that he had a surprise game in his car that the three of them could play together. The controller then asked the other adult to fetch the experimenter to assist them with the game, and as soon as the adult departed, the controller removed the toys and assembled the imitation task apparatus.

IMITATION TASK

The imitation task was essentially the same two-choice discrimination problem utilized in an earlier experiment (Bandura & Huston, 1961), except the response repertoires exhibited by the models were considerably extended, and the procedure used in the acquisition trials was somewhat modified.

The apparatus consisted of two small boxes with hinged lids, identical in color and size. The boxes were placed on stools approximately 4 feet apart and 8 feet from the starting point. On the lid of each box was a rubber doll.

As soon as the other adult returned with the experimenter, the controller asked both the child and the experimenter to be seated in the chairs along the side of the room, and the other adult to stand at the starting point, while the controller described the game they were about to play. The controller then explained that the experimenter would hide a picture sticker in one of the two boxes and the object of the game was to guess which box contained the sticker. The adults would have the first set of turns, following which the child would play the guessing game.

The discrimination problem was employed simply as a cover task that occupied the children's attention while at the same time permitted observation of the models as they performed divergent patterns of behavior during the discrimination trials in the absence of any set to attend to or learn the responses exhibited by the models.

Before commencing the trials, the controller invited the other participants to join him in selecting a "thinking cap" from hat racks containing two identical sets of four sailor caps, each of which had a different colored feather. The controller selected the green feathered hat, remarked, "Feather in the front" and wore the hat with the feather facing forward. The other model selected the yellow feathered hat, commented, "Feather in the back," and placed the hat on her head with the feather facing backward. The child then made his choice from the four hats in the lower rack and it was noted whether he matched the color preference, hat placement, and the verbal responses of the one or the other model.

The models then went to the starting point, the child returned to his seat, and the experimenter loaded both boxes with sticker pictures for the models' trials.

During the execution of each trial, each model exhibited a different set of relatively novel verbal and motor responses that were totally irrelevant to the discrimination problem to which the child's attention was directed. At the starting point the controller stood with his arms crossed, but at the experimenter's warning not to look, the controller placed his hands over his eyes, faced sideways and asked, "Ready?" The other model stood with his arms on his hips, then squatted with his back turned to the boxes and asked, "Now?"

As soon as the experimenter gave the signal for the first trial, the controller remarked, "Forward march" and began marching slowly toward the designated box repeating, "March, march, march." When he reached the box he said, "Sock him," hit the doll aggressively off the box, opened the lid and yelled, "Bingo," as he reached down for the sticker. He then remarked, "Lickit-sticket," as he pressed on the picture sticker with his thumb in the upper-right quadrant of a 24 × 24 inch sheet of plain white paper that hung on the wall immediately behind the boxes. The controller terminated the trial by replacing the doll facing sideways on the container with the comment, "Look in the mirror," and made a final verbal response, "There."

The other model then took her turn and performed a different set of imitative acts but equated with the controller's responses in terms of number, types of response classes represented, structural properties, and interest value. At the starting point, for example, she remarked, "Get set, go" and walked stiffly toward the boxes repeating "Left, right, left, right." When she reached the container she said, "Down and up," as she lay the doll down on the lid and opened the box. She then exclaimed, "A stickeroo," repeated, "Weto-smacko," and slapped on the sticker with the open hand in the lower-left quadrant of the sheet of paper. In terminating the trial, the model lay the doll on the lid of the container with the remark, "Lie down," and returned with her hands behind her back, and emitted the closing remark, "That's it."

The two sets of responses were counterbalanced by having the models display each pattern with half the subjects in each of the three groups.

The models performed alternately for four trials. At the conclusion of the fourth trial the controller explained that he had to check some materials in his car and while he and the other model were away the child may take his turns. Before they departed, however, the experimenter administered a picture preference test in which the models were asked to select their preferred picture from six different stickers pasted on a 5 × 8 inch card, after which the child was presented a similar card containing an identical set of stickers and requested to indicate his preference.

In addition to the introductory block of four trials by the models, the child's 15 total test trials were interspersed with three two-trial blocks by the models. The models were always absent from the room during the child's test series. This procedure was adopted in order to remove any imagined situational restraints against, or coercion for, the child to reproduce the models' responses. Moreover, demonstrations of delayed imitation in the absence of the model provides more decisive evidence for learning by means of imitation.

The models always selected different boxes, the right-left position varying from trial to trial in a fixed irregular order, and the controller always took the first turn. Although the models received stickers on each trial, the child was nonrewarded on one third of the trials in order to maintain his interest in the cover task.

At the beginning of each of the blocks of subjects' trials, the experimenter administered the picture preference test and the selection of stickers that matched the models' choices was recorded. In addition, on the eighth trial the models removed their hats and hung them in different locations in the room. If the child removed his hat during the session and placed it along side one or the other of the model's hats, this imitative act was also scored.

At the completion of the imitation phase of the experiment, the children were interviewed by the experimenter in order to determine whom they considered to be the controller of resources, and to assess their model preferences. The latter data were used as an index of attraction to the models. In addition, for the children in the adult consumer condition, the session was concluded by providing them the same lavish treatment accorded their adult rival.

Children in the control group had no prior social interaction with the models but participated with them in the imitative learning phase of the study. The experimenter assumed complete charge of the procedures and treated the models as though they were naive subjects. This control group was included primarily to determine the models' relative effectiveness as modeling stimuli. In addition, the models alternated between subjects in the order in which they executed the trials so as to test for the possibility of a primacy or a recency of exposure effect on imitative behavior.

IMITATION SCORES

The imitation scores were obtained by summing the frequency of occurrence of the postural, verbal, and motor responses described in the preceding section, and the hat, color, and picture preferences that matched the selections of each of the two models.

The children's performances were scored by three raters who observed the experimental sessions through a one-way mirror from an adjoining observation room. The raters were provided with a separate check list of responses exhibited by each of the two models, and the scoring procedure simply involved checking the imitative responses performed by the children on each trial. In order to provide an estimate of interscorer reliability, the performances of 30% of the children were recorded simultaneously but independently by two observers. The raters were in perfect agreement on 95% of the specific imitative responses that they scored.

Results

The control group data revealed that the two models were equally effective in eliciting imitative responses, the mean values being 17.83 and 20.46 for the male and female model, respectively; nor did the children display differential imitation of same-sex ($M = 22.30$) and opposite-sex ($M = 18.50$) models. Although children in the control group tended to imitate the second model ($M = 22.21$) to a somewhat greater extent than the one who performed first ($M = 16.08$) on each trial, suggesting a recency of exposure effect, the difference was not of statistically significant magnitude ($t = 1.60$).

Table 1 presents the mean imitation scores for children in each of the two experimental triads. A 2 × 2 × 2 × 2 mixed factorial analysis of variance was computed on these data in which the four factors in the design were sex of child, sex of the model who controlled the resources, adult versus child consumer,

TABLE 1

Mean Number of Imitative Responses Performed by Subgroups of Children in the Experimental Triads

	OBJECTS OF IMITATION			
Subjects	Male	Female	Female	Male
	Controller	Consumer	Controller	Consumer
Girls	29.00	9.67	26.00	10.00
Boys	30.17	18.67	22.33	16.17
total	29.59	14.17	24.17	13.09
	Controller	Ignored	Controller	Ignored
Girls	22.00	16.17	31.84	22.17
Boys	29.17	16.67	26.83	34.50
total	25.59	16.42	29.34	28.34

From Bandura, Ross and Ross, A comparative test of the status, envy, social power, and secondary reinforcement theories of identificatory learning.

and the controller versus the other model as the source of imitative behavior.[3] As shown in Table 2, the findings of this study clearly support the social power theory of imitation. In both experimental treatments, regardless of whether the rival adult or the children themselves were the recipients of the rewarding resources, the model who possessed rewarding power was imitated to a greater degree than was the rival or the ignored model ($F = 40.61$, $p < .001$). Nor did the condition combining resource ownership with direct reinforcement of the child yield the highest imitation of the model who controlled and dispensed the positive rewards. The latter finding is particularly surprising since an earlier experiment based on two-person groups (Bandura & Huston, 1961), demonstrated that pairing of model with positive reinforcement substantially enhanced the occurrence of imitative behavior. An examination of the remaining significant interaction effects together with the post-experimental interview data suggest a possible explanation for the discrepant results.

The differential in the controller-other model imitation was most pronounced when the male model was the controller of resources ($F = 4.76$, $p < .05$), particularly for boys. In fact, boys who were the recipients of rewarding resources mediated by the female model tended to favor the ignored male as their object of imitation. In the post-experiment interview a number of boys in this condition spontaneously expressed sympathy for the ignored male and mild criticism of the controller for not being more charitable with her bountiful resources (for example, "She

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[3] The assistance of Eleanor Willemsen with the statistical computations is gratefully acknowledged.

TABLE 2

Summary of the Analysis of Variance of the Imitation Scores

SOURCE	*df*	*MS*	*F*
Between subjects	47	310.17	
sex of subjects (A)	1	283.59	<1
sex of controller model (d)	1	128.34	<1
adult versus child consumer (C)	1	518.01	1.61
A × B	1	23.01	<1
A × C	1	1.76	<1
B × C	1	742.59	2.31
A × B × C	1	21.10	<1
error (b)	40	321.49	
Within subjects	48	113.24	
controller versus other model (D)	1	2,025.84	40.61***
A × D	1	297.51	5.96*
B × D	1	237.51	4.76*
C × D	1	396.09	7.94**
A × B × D	1	256.76	5.15*
A × C × D	1	19.52	<1
B × C × D	1	23.02	<1
A × B × C × D	1	184.00	3.69
error (w)	40	49.88	

* $p < .05$.
** $p < .01$.
*** $p < .001$.

From Bandura, Ross and Ross, A comparative test of the status, envy, social power, and secondary reinforcement theories of identificatory learning.

doesn't share much. John played bravely even though she didn't even share. . . . She's a bit greedy.").

As a partial check on whether this factor would tend to diminish the differential imitation of the two models, six children—three boys and three girls—participated in a modified Child Consumer treatment in which, halfway through the social interaction session, the ignored adult was informed that he too may have access to the playthings. He replied that he was quite content to read his book. This modified procedure, which removed the rivalry and the exclusion of the model, yielded four times as much imitation of the controller relative to the model who was ignored by choice.

The significant triple interaction effect indicates that the differential in the controller-other model imitation was greatest when the same-sex model mediated the positive reinforcers, and this effect was more pronounced for boys than for girls.

The data presented so far demonstrate that manipulation of rewarding power had produced differential imitation of the behavior exhibited by the two models. In order to assess whether the dispensing of positive reinforcers in the prior social interaction influenced the overall level of matching responses, the imitation scores in each of the three groups were summed across models and analyzed using a Sex × Treatment design.

The mean total imitative responses for children in the Child Consumer, Adult Consumer, and the Control group were 50.21, 40.58, and 37.88, respectively. Analysis of variance of these data reveals a significant treatment effect ($F = 3.37$, $.025 < p < .05$). Further comparisons of pairs of means by the t test, show that children in the child rewarded condition displayed significantly more imitative behavior than did children both in the Adult Consumer treatment ($t = 2.19$, $p < .05$), and those in the Control group ($t = 2.48$, $p < .02$). The Adult Consumer and Control groups, however, did not differ from each other in this respect ($t = .54$).

The model preference patterns were identical for children in the two experimental conditions and consequently, the data were combined for the statistical analysis. Of the 48 children, 32 selected the model who possessed rewarding power as the more attractive, while 16 preferred the noncontrolling adult. The greater attractiveness of the rewarding model was significant beyond the .05 level ($\chi^2 = 5.34$). The experimental triad in which boys were the recipients of positive reinforcers while the male model was ignored, and the female consumer-girl ignored subgroup, contributed the highest preference for the noncontrolling adult.

In addition to the experimental groups discussed in the preceding section, data are available for 9 children in the Adult Consumer condition, and for 11 children in the Child Consumer treatment who revealed, in their post-experiment interviews, that they had actually attributed rewarding power to the ignored or the consumer adult despite the elaborate experimental manipulations designed to establish differential power status. A number of these children were firmly convinced that only a male can possess resources and, therefore, the female dispensing the rewards was only an intermediary for the male model (for example, "He's the man and it's all his because he's a daddy. Mommy never really has things belong to her. . . . He's the daddy so it's his but he shares nice with the mommy. . . . He's the man and the man always really has the money and he lets ladies play too. John's good and polite and he has very good manners."). This view of resource ownership within the family constellation was often directly reinforced by the mothers (for example, "My mommy told me and Joan that the daddy really buys all the things, but the mommy looks after things."). Children who attributed the resource ownership to the consumer or ignored female model had considerable difficulty in explaining their selection (for example, "I just knowed it does. . . . I could tell, that's how."), perhaps, because the power structure they depicted is at variance with the widely accepted cultural norm.

As shown in Table 3, models who were attributed rewarding power elicited approximately twice as many matching responses than models who were perceived by the children as possessing no control over the rewarding resources. Because of the small and unequal number of cases in each cell, these data were not evaluated statistically. The differences, however, are marked and quite in accord with those produced by the experimentally manipulated variations in power status.

DISCUSSION

To the extent that the imitative behavior elicited in the present experiment may

TABLE 3

Imitation as a Function of Attributed Rewarding Power to the Models

	OBJECTS OF IMITATION			
TREATMENT CONDITION	Female controller	Male noncontroller	Male controller	Female noncontroller
Adult consumer	24.0	12.3	29.8	14.6
Child consumer	18.2	6.7	35.5	16.2

From Bandura, Ross, and Ross, A comparative test of the status, envy, social power, and secondary reinforcement theories of identificatory learning.

be considered an elementary prototype of identification within a nuclear family group, the data fail to support the interpretation of identificatory learning as the outcome of a rivalrous interaction between the child and the adult who occupies an envied status in respect to the consumption of highly desired resources. Children clearly identified with the source of rewarding power rather than with the competitor for these rewards. Moreover, power inversions on the part of the male and female models produced cross-sex imitation, particularly in girls. The differential readiness of boys and girls to imitate behavior exhibited by an opposite-sex model are consistent with findings reported by Brown (1956, 1958) that boys show a decided preference for the masculine role, whereas, ambivalence and masculine role preference are widespread among girls. These findings probably reflect both the differential cultural tolerance for cross-sex behavior displayed by males and females, and the privileged status and relatively greater positive reinforcement of masculine role behavior in our society.

Failure to develop sex appropriate behavior has received considerable attention in the clinical literature and has customarily been assumed to be established and maintained by psychosexual threat and anxiety reducing mechanisms. Our findings strongly suggest, however, that external social learning variables, such as the distribution of rewarding power within the family constellation, may be highly influential in the formation of inverted sex role behavior.

Theories of identificatory learning have generally assumed that within the family setting the child's initial identification is confined to his mother, and that during early childhood boys must turn from the mother as the primary model to the father as the main source of imitative behavior. However, throughout the course of development children are provided with ample opportunities to observe the behavior of both parents. The results of the present experiment reveal that when children are exposed to multiple models they may select one or more of them as the primary source of behavior, but rarely reproduce all the elements of a single model's repertoire or confine their imitation to that model. Although the children adopted many of the characteristics of the model who possessed rewarding power, they also reproduced some of the elements of behavior exhibited by the model who occupied the subordinate role. Consequently, the children were not simply junior-size replicas of one or the other model; rather, they exhibited a relatively novel pattern of behavior representing an amalgam of elements from both models. Moreover, the specific admixture of behavioral elements varied from child to child. These findings provide considerable evidence for the seemingly paradoxical conclusion that imitation can in fact produce innovation of social behavior, and that within the same family even same-sex siblings may exhibit quite different response patterns, owing to their having selected for imitation different elements of their parents' response repertoires.

The association of a model with noncontingent positive reinforcement tends to increase the incidence of imitative behavior in two person groups (Bandura & Huston, 1961), whereas the addition of a same-sex third person who is denied access to desired rewards may provoke in children negative evaluations of the rewarding model and thereby decreases his potency as a modeling stimulus. These two sets of data demonstrate how learning principles based on an individual behavior model may be subject to strict limitations, since the introduction of additional social variables into the stimulus complex can produce significant changes in the functional relationships between relevant variables.

REFERENCES

Bandura, A. Social learning through imitation. In M. R. Jones (Ed.), *Nebraska symposium on motivation: 1962*. Lincoln: Univer. Nebraska Press, 1962. Pp. 211–269.

Bandura, A., & Huston, Aletha C. Identification as a process of incidental learning. *J. abnorm. soc. Psychol.*, 1961, **63,** 311–318.

Bronfenbrenner, U. Freudian theories of identification and their derivatives. *Child Developm.*, 1960, **31,** 15–40.

Brown, D. G. Sex-role preference in young children. *Psychol. Monogr.*, 1956, **70** (14, Whole No. 421).

Brown, D. G. Sex-role development in a changing culture. *Psychol. Bull.*, 1958, **55,** 232–242.

French, J. R. P., Jr., Morrison, H. W., & Levinger, G. Coercive power and forces affecting conformity. *J. abnorm. soc. Psychol.*, 1960, **61,** 93–101.

French, J. R. P., Jr., & Raven, B. The bases of social power. In D. Cartwright (Ed.), *Studies in social power*. Ann Arbor, Mich.: Institute for Social Research, 1959. Pp. 150–167.

Freud, Anna. *The ego and the mechanisms of defense*. New York: International Univer. Press, 1946.

Freud, S. The passing of the Oedipus-complex. In, *Collected papers*. Vol. 2. London: Hogarth Press, 1924. Pp. 269–282.

Freud, S. *Group psychology and the analysis of the ego*. London: Hogarth Press, 1948.

Kagan, J. The concept of identification. *Psychol. Rev.*, 1958, **65,** 296–305.

Klein, Melanie. *The psycho-analysis of children*. London: Hogarth Press, 1949.

Maccoby, Eleanor E. Role-taking in childhood and its consequences for social learning. *Child Developm.*, 1959, **30,** 239–252.

Mowrer, O. H. Identification: A link between learning theory and psychotherapy. In, *Learning theory and personality dynamics*. New York: Ronald Press, 1950. Pp. 69–94.

Mowrer, O. H. Hearing and speaking: An analysis of language learning. *J. speech hear. Disord.*, 1958, **23,** 143–152.

Mussen, P., & Distler, L. Masculinity, identification, and father-son relationships. *J. abnorm. soc. Psychol.*, 1959, **59,** 350–356.

Parsons, T. Family structure and the socialization of the child. In T. Parsons & R. F.

Bales (Eds.), *Family, socialization, and interaction process.* Glencoe, Ill.: Free Press, 1955. Pp. 35–131.

Sears, R. R. Identification as a form of behavioral development. In D. B. Harris (Ed.), *The concept of development.* Minneapolis: Univer. Minnesota Press, 1957. Pp. 149–161.

Whiting, J. W. M. Sorcery, sin, and the superego: A cross-cultural study of some mechanisms of social control. In M. R. Jones (Ed.), *Nebraska symposium on motivation: 1959.* Lincoln: Univer. Nebraska Press, 1959. Pp. 174–195.

Whiting, J. W. M. Resource mediation and learning by identification. In I. Iscoe & H. W. Stevenson (Eds.), *Personality development in children.* Austin: Univer. Texas Press, 1960. Pp. 112–126.

Zipf, Sheila G. Resistance and conformity under reward and punishment. *J. abnorm. soc. Psychol.,* 1960, **61,** 102–109.

chapter VIII

Personality

THE FIELD of personality abounds with theoretical concepts suggesting processes within the individual which account for the individual's behavior. A learning approach, on the other hand, avoids the use of personality terms as labels for inferred inner processes which are never observed. A learning approach considers personality simply as behavior which is subject to the principles of conditioning. This theme will be developed in the papers which follow.

In the first article Skinner discusses some of the contributions made by Freud as well as the shortcomings involved in a psychoanalytic approach. Skinner considers Freud's greatest contribution to have been his insistence that human behavior is a natural event determined by other natural events—rather than as capricious and not subject to scientific study. Skinner also indicates that although Freud was interested in the effects of environmental occurrences upon later behavior, he posited that the environmental effects worked through inferred mental apparatus of various kinds. Psychoanalysis thus became more concerned with these internal fictions than with the specification of the environmental conditions and the consequent behaviors.

The next article by Staats is presented as one contemporary example of the contention that psychoanalysis focused attention on supposed inner determinants of behavior, rather than on observable environmental conditions. It may be suggested that the conception that focuses the clinical practitioner's efforts on speculation concerning unobservable inner causes of disturbed behavior has the unfortunate effect of detracting from the search for potentially observable and manipulatable environmental determinants of the behavior. This example concerns a case in which there is interest in an "abnormal" behavior as symbolic of some inner process, rather than as a behavior which has been shaped by environmental events according to learning principles. The article also suggests in general (1) that some of hospitalized psychotics' abnormal behaviors may be shaped in the hospital environment by the conditions of reinforcement in effect and (2) that abnormal behaviors could be changed (treated) using reinforcement procedures—both suggestions finding experimental support in several studies presented in the next chapter.

An additional problem of most personality theories seems to be with the nature of observations upon which they are based. For the most part, the various conceptions are derived from naturalistic observations of the patient's behavior (primarily his verbal behavior) in the clinical interview. The next article by Quay indicates why the verbal behavior of the patient in the clinical interview cannot be considered to give the personality theorist information concerning independent variables which have affected the patient. The patients' verbal reports are subject to the conditions of reinforcement *in* the interview. One of the important bases of psychoanalytic theory concerns the individual's early memories (or reports of them). Quay shows that this behavior can be manipulated according to reinforcement principles, and in a direction which could spuriously corroborate a theory.

A number of investigators have also become interested in showing that significant human behaviors, which are called personality, are subject to the principles of learning. In the two examples of such studies to be presented, the article by Eriksen and Kuethe commences an experimental analysis of repression. This study may be considered to show general principles by which verbal responses acquire aversive properties, and, as a consequence, assume weaker positions in the individual's verbal repertoire. These principles also have implications for understanding such behavioral problems as rationalization, projection, fantasy, and the like.

The next study by Staats, Staats, Heard, and Finley treats personality traits as behaviors which can be acquired according to the principles of reinforcement. The traits involved in this study are those which are measured on standard personality tests based upon factor analytic methods. The interpretation of factor traits as classes of behavior acquired and maintained according to learning principles also contains explanatory value for the purely descriptive character of psychometrics. (See also Nuthmann, 1957; Oakes and Droge, 1960.)

The suggestion of this sample of studies and the general learning orientation is that the behaviors which have been considered in previous sections of the present book, plus the section which is to follow, are all "personality" behaviors. In the first section several types of personality behaviors were considered in learning terms. This was also true in papers on verbal behavior, communication, problem solving, purpose, attitude learning, and social interaction; and the following section indicates similar findings in the area of behavior disorders. The implication that all of the behaviors of the individual are "personality" is rather strong, as is the suggestion that most of these are learned.

This conception may be extended into the realm of abnormal behaviors. Abnormal personality, as well as normal, may be considered to be behaviors which are acquired, at least in part, according to the principles of learning (as will be elaborated within the context of treatment in the next section). The next article by Ferster directs itself to an analysis of learning conditions in early childhood which may result in an abnormal personality or, in our terms, abnormal behaviors.

The abnormal behavior of the autistic child is analyzed in terms of deficits in the child's repertoire, lack of stimulus control, inappropriate behaviors, and so on. As such, this article is a good example of a learning approach to an aspect of personality. The analysis commences with examination of the *behavior* which is of interest. It then proceeds to explore the types of antecedent (learning) conditions which might account for the behavior or in this case the lack of behavior. A complete learning theory of personality requires many such analyses. Since there are no observations of internal "personality" processes, the analysis makes no conjectures regarding such processes. The essential difference in method here is that the learning analysis suggests conditions which might be manipulated to prevent or change the undesirable behavior involved.

38.

Critique of Psychoanalytic Concepts and Theories*

B. F. Skinner

Freud's great contribution to Western thought has been described as the application of the principle of cause and effect to human behavior. Freud demonstrated that many features of behavior hitherto unexplained—and often dismissed as hopelessly complex or obscure—could be shown to be the product of circumstances in the history of the individual. Many of the casual relationships he so convincingly demonstrated had been wholly unsuspected—unsuspected, in particular, by the very individuals whose behavior they controlled. Freud greatly reduced the sphere of accident and caprice in our considerations of human conduct. His achievement in this respect appears all the more impressive when we recall that he was never able to appeal to the quantitative proofs characteristic of other sciences. He carried the day with sheer persuasion—with the massing of instances and the delineation of surprising parallels and analogies among seemingly diverse materials.

This was not, however, Freud's own view of the matter. At the age of 70 he summed up his achievement in this way (*1*):

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* From B. F. Skinner, Critique of psychoanalytic concepts and theories, *The Scientific Monthly*, **79**, 300–305 (1954). Reprinted by permission of the author and *The Scientific Monthly*.

> My life has been aimed at one goal only: to infer or guess how the mental apparatus is constructed and what forces interplay and counteract in it.

It is difficult to describe the mental apparatus he refers to in noncontroversial terms, partly because Freud's conception changed from time to time and partly because its very nature encouraged misinterpretation and misunderstanding. But it is perhaps not too wide of the mark to indicate its principal features as follows: Freud conceived of some realm of the mind, not necessarily having physical extent, but nevertheless capable of topographic description and of subdivision into regions of the conscious, coconscious, and unconscious. Within this space, various mental events—ideas, wishes, memories, emotions, instinctive tendencies, and so on—interacted and combined in many complex ways. Systems of these mental events came to be conceived of almost as subsidiary personalities and were given proper names: the id, the ego, and the superego. These systems divided among themselves a limited store of psychic energy. There were, of course, many other details.

No matter what logicians may eventually make of this mental apparatus, there is little doubt that Freud accepted it as real rather than as a scientific construct or theory. One does not at the age of 70 define the goal of one's life as the exploration of an explanatory fiction. Freud did not use his "mental apparatus" as a postulate system from which he deduced theorems to be submitted to empirical check. If there was any interaction between the mental apparatus and empirical observations, it took the form of modifying the apparatus to account for newly discovered facts. To many followers of Freud the mental apparatus appears to be equally as real, and the exploration of such an apparatus is similarly accepted as the goal of a science of behavior. There is an alternative view, however, which holds that Freud did not discover the mental apparatus but rather invented it, borrowing part of its structure from a traditional philosophy of human conduct but adding many novel features of his own devising.

There are those who will concede that Freud's mental apparatus was a scientific construct rather than an observable empirical system but who, nevertheless, attempt to justify it in the light of scientific method. One may take the line that metaphorical devices are inevitable in the early stages of any science and that although we may look with amusement today upon the "essences," "forces," "phlogistons," and "ethers," of the science of yesterday, these nevertheless were essential to the historical process. It would be difficult to prove or disprove this. However, if we have learned anything about the nature of scientific thinking, if mathematical and logical researches have improved our capacity to represent and analyze empirical data, it is possible that we can avoid some of the mistakes of adolescence. Whether Freud could have done so is past demonstrating, but whether we need similar constructs in the future prosecution of a science of behavior is a question worth considering.

Constructs are convenient and perhaps even necessary in dealing with certain complicated subject matters. As Frenkel-Brunswik shows (2), Freud was aware of the problems of scientific methodology and even of the metaphorical nature of some of his own constructs. When this was the case, he justified the constructs as necessary or at least highly convenient. But awareness of the nature of the metaphor is no defense of it, and if modern science is still occasionally metaphorical, we must remember that theory-wise it is also still in trouble. The point is not that metaphor or construct is objectionable but that particular metaphors and constructs have caused trouble and are continuing to do so. Freud recognized the damaged worked by his own metaphorical thinking, but he felt that it could not be avoided and that the damage must be put up with. There is reason to disagree with him on this point.

Freud's explanatory scheme followed a traditional pattern of looking for a cause of human behavior inside the organism. His medical training supplied him with powerful supporting analogies. The parallel between the excision of a tumor, for example, and the release of a repressed wish from the unconscious is quite compelling and must have affected Freud's thinking. Now, the pattern of an inner explanation of behavior is best exemplified by doctrines of animism, which are primarily concerned with explaining the spontaneity and evident capriciousness of behavior. The living organism is an extremely complicated system behaving in an extremely complicated way. Much of its behavior appears at first blush to be absolutely unpredictable. The traditional procedure had been to invent an inner determiner, a "demon," "spirit," "homunculus," or "personality" capable of spontaneous change of course or of origination of action. Such an inner determiner offers only a momentary explanation of the behavior of the outer organism, because it must, of course, be accounted for also, but it is commonly used to put the matter beyond further inquiry and to bring the study of a causal series of events to a dead end.

Freud, himself, however, did not appeal to the inner apparatus to account for spontaneity or caprice because he was a thoroughgoing determinist. He accepted the responsibility of explaining, in turn, the behavior of the inner determiner. He did this by pointing to hitherto unnoticed external causes in the environmental and genetic history of the individual. He did not, therefore, need the traditional explanatory system for traditional purposes; but he was unable to eliminate the pattern from his thinking. It led him to represent each of the causal relationships he had discovered as a series of three events. Some environmental condition, very often in the early life of the individual, leaves an effect upon the inner mental apparatus, and this in turn produces the behavioral manifestation or symptom. Environmental event, mental state or process, behavioral symptom—these are the three links in Freud's causal chain. He made no appeal to the middle link to explain spontaneity or caprice. Instead he used it to bridge the gap in space and time between the events he had proved to be causally related.

A possible alternative, which would have had no quarrel with established science, would have been to argue that the environmental variables leave *physiological* effects that may be inferred from the behavior of the individual, perhaps at a much later date. In one sense, too little is known at the moment of these physiological processes to make them useful in a legitimate way for this purpose. On the other hand, too much is known of them, at least in a negative way. Enough is known of the nervous system to place certain dimensional limits upon speculation and to clip the wings of explanatory fiction. Freud accepted, therefore, the traditional fiction of a mental life, avoiding an out-and-out dualism by arguing that eventually physiological counterparts would be discovered. Quite apart from the question of the existence of mental events, let us observe the damage that resulted from this maneuver.

We may touch only briefly upon two classical problems that arise once the conception of a mental life has been adopted. The first of these is to explain how such a life is to be observed. The introspective psychologists had already tried to solve this problem by arguing that introspection is only a special case of the observation upon which all science rests and that man's experience necessarily stands between him and the physical world with which science purports to deal. But it was Freud himself who pointed out that not all of one's mental life was accessible to direct observation—that many events in the mental apparatus were necessarily inferred. Great as this discovery was, it would have been still greater if Freud had taken the next step, advocated a little later by the American movement called Behaviorism, and insisted that conscious, as well as unconscious, events were inferences from the facts. By arguing that the individual organism simply reacts to its environment, rather than to some inner experience of that environment, the bifurcation of nature into physical and psychic can be avoided (3).

A second classical problem is how the mental life can be manipulated. In the process of therapy, the analyst necessarily acts upon the patient only through physical means. He manipulates variables occupying a position in the first link of Freud's causal chain. Nevertheless, it is commonly assumed that the mental apparatus is being directly manipulated. Sometimes it is argued that processes are initiated within the individual himself, such as those of free association and transference, and that these in turn act directly upon the mental apparatus. But how are these mental processes initiated by physical means? The clarification of such a causal connection places a heavy and often unwelcome burden of proof upon the shoulders of the dualist.

The important disadvantages of Freud's conception of mental life can be described somewhat more specifically. The first of these concerns the environmental variables to which Freud so convincingly pointed. The cogency of these variables was frequently missed because the variables were transformed and obscured in the course of being represented in mental life. The physical world of the organism was converted into conscious and unconscious experience, and these experiences were further transmuted as they combined and changed in mental processes. For example, early punishment of sexual behavior is an observable fact that undoubtedly leaves behind a changed organism. But when this change is represented as a state of conscious or unconscious anxiety or guilt, specific details of the punishment are lost. When, in turn, some unusual characteristic of the sexual behavior of the adult individual is related to the supposed guilt, many specific features of the relationship may be missed that would have been obvious if the same features of behavior had been related to the punishing episode. Insofar as the mental life of the individual is used as Freud used it to represent and to carry an environmental history, it is inadequate and misleading.

Freud's theory of the mental apparatus had an equally damaging effect upon his study of behavior as a dependent variable.

Inevitably, it stole the show. Little attention was left to behavior per se. Behavior was relegated to the position of a mere mode of expression of the activities of the mental apparatus or the symptoms of an underlying disturbance. Among the problems not specifically treated in the manner that was their due, we may note five.

1) The nature of the act as a unit of behavior was never clarified. The simple *occurrence* of behavior was never well represented. "Thoughts" could "occur" to an individual; he could "have" ideas according to the traditional model; but he could "have" behavior only in giving expression to these inner events. We are much more likely to say that "the thought occurred to me to ask him his name" than that "the act of asking him his name occurred to me." It is in the nature of thoughts and ideas that they occur to people, but we have never come to be at home in describing the emission of behavior in a comparable way. This is especially true of verbal behavior. In spite of Freud's valuable analysis of verbal slips and of the techniques of wit and verbal art, he rejected the possibility of an analysis of verbal behavior in its own right rather than as the expression of ideas, feelings, or other inner events, and therefore missed the importance of this field for the analysis of units of behavior and the conditions of their occurrence.

The behavioral nature of perception was also slighted. To see an object as an object is not mere passive sensing; it is an act, and something very much like it occurs when we see an object although no object is present. Fantasy and dreams were for Freud not the perceptual *behavior* of the individual but pictures painted by an inner artist in some atelier of the mind which the individual then contemplated and perhaps then reported. This division of labor is not essential when the behavioral component of the act of seeing is emphasized.

2) The dimensions of behavior, particularly its dynamic properties, were never adequately represented. We are all familiar with the fact that some of our acts are more likely to occur upon a given occasion than others. But this likelihood is hard to represent and harder to evaluate. The dynamic changes in behavior that are the first concern of the psychoanalyst are primarly changes in probability of action. But Freud chose to deal with this aspect of behavior in other terms—as a question of "libido," "cathexis," "volume of excitation," "instinctive or emotional tendencies," "available quantities of psychic energy," and so on. The delicate question of how probability of action is to be quantified was never answered, because these constructs suggested dimensions to which the quantitative practices of science in general could not be applied.

3) In his emphasis upon the genesis of behavior, Freud made extensive use of processes of learning. These were never treated operationally in terms of changes in behavior but rather as the acquisition of ideas, feelings, and emotions later to be expressed by, or manifested in, behavior. Consider, for example, Freud's own suggestion that sibling rivalry in his own early history played an important part in his theoretical considerations as well as in his personal relationships as an adult.

An infant brother died when Freud himself was only 1½ years old, and as a young child Freud played with a boy somewhat older than himself and presumably more powerful, yet who was, strangely enough, in the nominally subordinate position of being his nephew. To classify such a set of circumstances as sibling rivalry obscures, as we have seen, the many specific properties of the circumstances themselves regarded as independent variables in a science of behavior. To argue that *what was learned* was the effect of these circumstances upon unconscious or conscious aggressive tendencies or feelings of guilt works a similar misrepresentation of the dependent variable. An emphasis upon behavior would lead us to inquire into the specific acts plausibly assumed to be engendered by these childhood episodes. In very specific terms, how was the behavior of the young Freud *shaped* by the special reinforcing contingencies arising from the presence of a younger child in the family, by the death of that child, and by later association with an older playmate who nevertheless occupied a subordinate family position? What did the young Freud *learn to do* to achieve parental attention under these difficult circumstances? How did he avoid aversive consequences? Did he exaggerate any illness? Did he feign illness? Did he make a conspicuous display of behavior that brought commendation? Was such behavior to be found in the field of physical prowess or intellectual endeavor? Did he learn to engage in behavior that would in turn increase the repertoires available to him to achieve commendation? Did he strike or otherwise injure young children? Did he learn to injure them verbally by teasing? Was he punished for this, and if so, did he discover other forms of behavior that had the same damaging effect but were immune to punishment?

We cannot, of course, adequately answer questions of this sort at so late a date, but they suggest the kind of inquiry that would be prompted by a concern for the *explicit shaping of behavioral repertoires* under childhood circumstances. What has survived through the years is not aggression and guilt, later to be manifested in behavior, but rather patterns of behavior themselves. It is not enough to say that this is "all that is meant" by sibling rivalry or by its effects upon the mental apparatus. Such an expression obscures, rather than illuminates, the nature of the behavioral changes taking place in the childhood learning process. A similar analysis could be made of processes in the fields of motivation and emotion.

4) An explicit treatment of behavior as a datum, of probability of response as the principal quantifiable property of behavior, and of learning and other processes in terms of changes of probability is usually enough to avoid another pitfall into which Freud, in common with his contemporaries, fell. There are many words in the layman's vocabulary that suggest the activity of an organism yet are not descriptive of behavior in the narrower sense. Freud used many of these freely—for example, the individual is said to discriminate, remember, infer, repress, decide, and so on. Such terms do not refer to specific acts. We say that a man discriminates between two objects when he behaves differently with respect to them; but discriminating is not itself behavior. We say that he represses behavior which has been punished when he engages in other behavior *just because* it displaces the punished behavior; but repressing is not action. We say that he decides upon a course of conduct either when he enters upon one course to the exclusion of another, or when he alters some of the variables affecting his own behavior in order to bring this about; but there is no other "act of deciding." The difficulty is that when one uses terms which suggest an activity, one feels it necessary to invent an actor, and the subordinate personalities in the Freudian mental apparatus do, indeed, participate in just these activities

rather than in the more specific behavior of the observable organism.

Among these activities are conspicuous instances involving the process of self-control—the so-called "Freudian mechanisms." These need not be regarded as activities of the individual or any subdivision thereof—they are not, for example, what happens when a skillful wish evades a censor—but simply as ways of representing relationships among responses and controlling variables. I have elsewhere tried to demonstrate this by restating the Freudian mechanisms without reference to Freudian theory (*4*).

5) Since Freud never developed a clear conception of the behavior of the organism and never approached many of the scientific problems peculiar to that subject matter, it is not surprising that he misinterpreted the nature of the observation of one's own behavior. This is admittedly a delicate subject, which presents problems which no one, perhaps, has adequately solved. But the act of self-observation can be represented within the framework of physical science. This involves questioning the reality of sensations, ideas, feelings, and other states of consciousness which many people regard as among the most immediate experiences of their life. Freud himself prepared us for this change. There is, perhaps, no experience more powerful than that which the mystic reports of his awareness of the presence of God. The psychoanalyst explains this in other ways. He himself, however, may insist upon the reality of certain experiences that others wish to question. There are other ways of describing what is actually seen or felt under such circumstances.

Each of us is in particularly close contact with a small part of the universe enclosed within his own skin. Under certain limited circumstances, we may come to react to that part of the universe in unusual ways. But it does not follow that that particular part has any special physical or nonphysical properties or that our observations of it differ in any fundamental respect from our observations of the rest of the world. I have tried to show elsewhere (*4*) how self-knowledge of this sort arises and why it is likely to be subject to limitations that are troublesome from the point of view of physical science. Freud's representations of these events was a particular personal contribution influenced by his own cultural history. It is possible that science can now move on to a different description of them. If it is impossible to be wholly nonmetaphorical, at least we may improve upon our metaphors.

The crucial issue here is the Freudian distinction between the conscious and unconscious mind. Freud's contribution has been widely misunderstood. The important point was not that the individual was often unable to describe important aspects of his own behavior or identify important causal relationships but that his ability to describe them was irrelevant to the occurrence of the behavior or to the effectiveness of the causes. We begin by attributing the behavior of the individual to events in his genetic and environmental history. We then note that because of certain cultural practices, the individual may come to describe some of that behavior and some of those causal relationships. We may say that he is conscious of the parts he can describe and unconscious of the rest. But the act of self-description, as of self-observation, plays no part in the determination of action. It is superimposed upon behavior. Freud's argument that we need not be aware of important causes of conduct leads naturally to the broader conclusion that awareness of cause has nothing to do with causal effectiveness.

In addition to these specific consequences of Freud's mental apparatus in obscuring important details among the variables of which human behavior is a function and in leading to the neglect of important problems in the analysis of behavior as a primary datum, we have to note the most unfortunate effect of all. Freud's methodological strategy has prevented the incorporation of psychoanalysis into the body of science proper. It was inherent in the nature of such an explanatory system that its key entities would be unquantifiable in the sense in which entities in science are generally quantifiable, but the spatial and temporal dimensions of these entities have caused other kinds of trouble.

One can sense a certain embarrassment among psychoanalytic writers with respect to the primary entities of the mental apparatus. There is a predilection for terms that avoid the embarrassing question of the spatial dimensions, physical or otherwise, of terms at the primary level. Although it is occasionally necessary to refer to mental events and their qualities and to states of consciousness, the analyst usually moves on in some haste to less committal terms such as *forces, processes, organizations, tensions, systems,* and *mechanisms.* But all these imply terms at a lower level. The notion of a conscious or unconscious "force" may be a useful metaphor, but if this is analogous to force in physics, what is the analogous mass that is analogously accelerated? Human behavior is in a state of flux and undergoing changes that we call "processes," but what is changing in what direction when we speak of, for example, an affective process? Psychological "organizations," "mental systems," "motivational interaction"—these all imply arrangements or relationships among *things,* but what are the things so related or arranged? Until this question has been answered the problem of the dimensions of the mental apparatus can scarcely be approached. It is not likely that the problem can be solved by working out independent units appropriate to the mental apparatus, although it has been proposed to undertake such a step in attempting to place psychoanalysis on a scientific footing.

Before one attempts to work out units of transference or scales of anxiety, or systems of mensuration appropriate to the regions of consciousness, it is worth asking whether there is not an alternative program for a *rapprochement* with physical science that would make such a task unnecessary. Freud could hope for an eventual union with physics or physiology only through the discovery of neurological mechanisms that would be the analogs of, or possibly only other aspects of, the features of his mental apparatus. Since this depended upon the prosecution of a science of neurology far beyond its current state of knowledge, it was not an attractive future. Freud appears never to have considered the possibility of bringing the concepts and theories of a psychological science into contact with the rest of physical and biological science by the simple expedient of an operational definition of terms. This would have placed the mental apparatus in jeopardy as a life goal, but it would have brought him back to the observable, manipulable, and preeminently physical variables with which he was in the last analysis dealing.

REFERENCES AND NOTES

1. E. Jones, *Life and Work of Sigmund Freud* (Basic Books, New York, 1953), vol. 1.

2. E. Frenkel-Brunswik, p. 293 of this issue.
3. Although it was Freud himself who taught us to doubt the face value of introspection, he appears to have been responsible for the view that another sort of direct experience is required if certain activities in the mental apparatus are to be comprehended. Such a requirement is implied in the modern assertion that only those who have been psychoanalyzed can fully understand the meaning of transference or the release of a repressed fear.
4. B. F. Skinner, *Science and Human Behavior* (Macmillan, New York, 1953).

39.

Learning Theory and "Opposite Speech"*

Arthur W. Staats

Laffal, Lenkoski, and Ameen (4), have recently reported the case of a schizophrenic patient demonstrating what they call an "opposite speech" syndrome. The authors state that the syndrome is basically a reversal in certain language usages, especially in the use of "yes" and "no." Feeling that the speech reversal is an expression of repressed hostility, they suggest that opposite speech copes with the hostile impulses by disrupting communication and rejecting other people or by allowing the "verbalization of ideas which the patient consciously rejects" (4, p. 412).

Laffal *et al.* conclude that learning theory has little to offer in this instance or others of pathological speech ". . . [T]he so-called pragmatic and interpersonal functions of language behavior have been largely neglected by learning theorists in favor of the meaning or semantic aspects" (4, p. 412).

However, a number of recent experimental and theoretical studies (such as 1, 2, 3, 5, 6, 7, 9, 10) have been very much concerned with similar problems of language behavior. Several points can thus be made from a learning theory approach which have relevance for "opposite speech." Skinner, for example, generally defines verbal behavior as "behavior which is reinforced through the mediation of another organism" (7, p. 20). Instead of asking, as do Laffal *et al.*, "what uses [needs] the opposite speech may serve" (4, p. 412), reinforcement theory is concerned with the conditions which increase the probability that the response will occur again in similar stimulus situations or which strengthen the response.

It has been shown experimentally (1, 3, 9, 10) that social reinforcement which follows verbal responses has the effect of increasing their frequency. These studies have used various social reinforcements. The question is thus raised regarding the reinforcements involved in opposite speech. One possibility may be taken from a discussion of generalized reinforcers by Skinner.

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* From A. W. Staats, Learning theory and "opposite speech," *J. abnorm. soc. Psychol.*, **55**, 268–269 (1957). Reprinted by permission of the author and the American Psychological Association.

> The child who misbehaves "just to get attention" is familiar. The attention of people is reinforcing because it is a necessary condition for other reinforcements from them. . . . The attention of someone who is particularly likely to supply reinforcement —a parent, a teacher, or a loved one–is an especially good generalized reinforcer and sets up especially strong attention-getting behavior (8, p. 78).

It is suggested that attention, operating as a generalized reinforcer, could account in part for the origin and maintenance of opposite speech. The interview quoted by Laffal (4, p. 411) is a good demonstration of how the patient's opposite speech could elicit attention from others. Other reinforcers would also be effective in strengthening reversed language. For example, the patient's reversals were said to "not extend to . . . thought or action. Thus, if asked if he wishes a cigaret, the patient may say, 'No' instead of 'Yes, I do,' but he accepts and smokes the cigaret" (4, p. 412). Giving the cigaret to the "No" response is a reinforcement and would be expected to strengthen that response, i.e., raise the probability that the patient would again say "No" in the same situation. Reinforcements such as these, without concomitant admonition, would be unlikely to occur in the normal person's social environment.

Certain implications are derivable from this interpretation. If the opposite speech is maintained by positive reinforcement, then lack of such reinforcement should lead to extinction of such behavior. For example, withholding the cigaret should weaken the strength of opposite speech, and giving the cigaret to correct speech should strengthen that type of response.

Another example of learning theory formulations applicable to opposite speech is offered by Dollard and Miller (2). They discuss repression in terms of reinforcement theory. Certain thoughts arouse anxiety. Cessation of thinking those thoughts reduces anxiety. Thus, stopping thinking about that topic becomes a well-learned response. The same analysis can be applied to speech. Dollard and Miller (2) give an example of a group of people who change the topic of a conversation because it arouses anxiety, and state, "people tend to learn to avoid unpleasant topics of conversation" (2, p. 199).

It could be said that the schizophrenic patient's verbal behavior, when it is not confused by reversal, elicits an anxiety response in him, perhaps because of its typical content. Confused ways of speaking, and perhaps even of thinking, would therefore be anxiety reducing. This rationale could be extended to obsessive thinking in addition to other types of confused schizophrenic speech and thought. In addition, for the schizophrenic, communication with others which is understandable probably introduces touchy subjects which arouse anxiety. Reversed verbal behavior and other confused speech may reduce anxiety when it produces breakdown of the communication and cessation of the anxiety producing subject matter or of the bothersome conversation itself.

Why the schizophrenic's speech might elicit anxiety in him need not herein be elaborated, since the speech symptom is the relevant topic. It could be stated, however, that the unhappy life situation of an adult schizophrenic probably elicits thought and speech which are not positive secondary reinforcers, but instead arouse anxiety. It is also probable that the lack of success of the schizophrenic's life behavior evokes verbal behavior from others which is anxiety producing for the schizophrenic. Verbal and nonverbal behavior of the schizophrenic which would avoid this anxiety would thus be well learned.

In concluding, it should be stated that this note is not intended as a complete analysis of the opposite speech of the schizophrenic patient. Perhaps it points out that hypotheses which apply to pathological language can be derived from a learning theory approach. At any rate, it is suggested that learning theory has reached a state where it has something to offer clinical theory *and practice*. The complex activities to which contemporary learning theory addresses itself, and not without success, indicate that the approach can no longer be ignored.

REFERENCES

1. Cohen, D. J., Kalish, H. I., Thurston, J. R., & Cohen, E. Experimental manipulation of verbal behavior. *J. exp. Psychol.*, 1954, **47,** 106–110.
2. Dollard, J., & Miller, N. E. *Personality and psychotherapy*. New York: McGraw-Hill, 1950.
3. Greenspoon, J. The effect of verbal and nonverbal stimuli on the frequency of members of two verbal response classes. Unpublished doctor's dissertation, Univer. of Indiana, 1950.
4. Laffal, J., Lenkoski, L. D., & Ameen, L. "Opposite speech" in a schizophrenic patient. *J. abnorm. soc. Psychol.*, 1956, **52,** 409–413.
5. Miller, N. E., & Dollard, J. *Social learning and imitation*. New Haven: Yale Univer. Press, 1941.
6. Mowrer, O. H. The psychologist looks at language. *Amer. Psychologist*, 1954, **9,** 660–694.
7. Skinner, B. F. *Verbal behavior*. William James Lectures, Harvard Univer., 1947 (mimeo.).
8. Skinner, B. F. *Science and human behavior*. New York: Macmillan, 1953.
9. Talbot, E. The effect of note taking upon verbal responses and its implications for the interview. Unpublished doctor's dissertation, Univer. of California at Los Angeles, 1954.
10. Verplank, W. S. The control of the content of conversation: reinforcement of statements of opinion. *J. abnorm. soc. Psychol.*, 1955, **51,** 668–676.

40.

The Effect of Verbal Reinforcement on the Recall of Early Memories*[1]

Herbert Quay

Most present-day theories of human personality and of the historical and dynamic causes of human behavior were originally formulated by individuals practicing psychotherapy. In fact, it was the memories and free associations of neurotic patients that led Freud to formulate his theory of psychosexual development. Similarly, the memories and free associations of patients talking to other such innovators have led to very different conceptions of the origins of human personality. Even though these personality theorists presumably began with the same raw verbal materials, however, it is apparent that they derived quite different formulations of human motives and conflicts. Moreover, the various schools have defended their positions mainly on the basis of further psychotherapeutic contacts with patients, with no resolution of the theoretical differences. One may suspect, therefore, that observations which are highly stimulating in the formation of hypotheses may not be very useful in their verification or testing (Hunt, 1952).

Logical analysis makes it evident that if psychoanalytical therapy, or any other form of psychotherapy, is to serve the hypothesis-testing as well as the hypothesis-finding role, it is absolutely necessary to assume that the verbal productions of patients are free of influence from the therapist. Suspicions that the psychotherapist, however unintentionally, does influence subtly the productions of his patients have already been voiced. Bach (1952) observed that the human figure drawings produced by his patients during psychotherapy were different in their content from those produced by patients of his psychoanalyst officemate. Furthermore, the differences appeared in the way the content reflected the theoretical biases of each therapist. Heine (1953) studied patients who had successfully completed psychotherapy with therapists of different theoretical orientations. He found that the reasons given by patients for their improvement corresponded to the theoretical convictions of their therapists about what is therapeutic.

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* From H. Quay, The effect of verbal reinforcement on the recall of early memories, *J. abnorm. soc. Psychol.*, **59**, 254–257 (1959). Reprinted by permission of the author and the American Psychological Association.

[1] An abstract of a Ph.D. thesis done at the University of Illinois under the direction of J. McV. Hunt. The author wishes to express his appreciation to J. McV. Hunt, Lee J. Cronbach, G. R. Grice, L. A. Hellmer, D. R. Peterson, and M. M. Ohlsen, members of his doctoral committee.

The recent literature on the operant conditioning of verbal behavior may provide a paradigm to account for these subtle influences. Stemming from the work of Greenspoon (1951, 1955), Verplanck (1955a, 1955b), and Wilson and Verplanck (1956), a rather wide variety of verbal behavior has shown itself subject to manipulation by another person through the use of verbal reinforcing stimuli. From the increase in the probability of saying words of certain classes (Greenspoon: 1951, 1955; Sidowski, 1954; Wilson & Verplanck, 1956) through the increase in complex types of discourse (Verplanck, 1955a), a wide variety of verbal behavior has been manipulated by the use of reinforcing stimuli with the added finding that subjects (*S*s) are generally unaware that their behavior has been manipulated. No study to date, however, has demonstrated that highly personal, emotionally charged verbalizations are subject to manipulation when the participation of the experimenter (*E*) is minimal. Since these are the types of verbal productions important in psychotherapy, it is necessary, for the argument presented here, to show that such verbal responses are subject to the effect reported for more impersonal materials.

The hypothesis tested in this study is that a verbal reinforcing stimulus increases the frequency of certain types of early childhood memories over their frequency in a "free-operant" period before any reinforcement is applied.

Method

The method of this study was to have a number of college students report memories of their early childhood. After a baseline was established in a "free-operant" period, verbal reinforcement at a minimal level, the interviewer saying "uh-huh," was introduced to reinforce selected memory topics.

SUBJECTS

*S*s were chosen from a large class of undergraduates in introductory psychology at the University of Illinois, where each student is required to serve for five hours as *S* of psychological experimentation. *S*s for this study volunteered for an experiment presented as involving the recall of childhood events.

The experimental groups were composed of 16 *S*s in a group for which memories concerned with their families were reinforced ("family" group—nine females and seven males) and 18 *S*s in a group for which memories concerned with people and events outside the family were reinforced ("nonfamily" group—ten females and eight males).

The "family" and "nonfamily" classes of memories were chosen because they could be identified reliably and could provide adequate initial operant levels to insure an early appearance of the operant response in the reinforcement period. Instructions for scoring, with examples, may be found in Quay, 1958.

The reinforcing stimulus chosen was a flat, noncommittal "uh-huh," spoken in a low conversational tone. Such minimal reinforcement was chosen because it is in keeping with a general psychotherapeutic type of response and because if a response this minimal could influence verbal behavior, then almost any remark of a psychotherapist would be reinforcing.

All *S*s reported for the experiment to *E*'s office at the Psychological Clinic. *S*s were instructed to recall events from their early childhood as they came to mind. *S*s were seated in a comfortable chair facing away from *E*. All responses were tape recorded by means of a microphone given to each *S* at the time he received his instructions.

The experimental period was divided into two half-hour sessions, generally one week apart. The first 10 min. of the first half-hour were used to establish the operant level (relative frequency) of the category subsequently to be reinforced. This procedure served to make each *S* his own control. At the end of the first half-hour, *S* was interrupted and asked to return one week later for another half-hour. At the end of the second and final half-hour, *S*s were asked to cooperate further by filling out a questionnaire to be sent to them at a later date.

The questionnaire was designed to elicit information about the degree of *S*'s awareness of the contingency between his memories and the reinforcing stimulus. While it may have been more informative to question each *S* verbally at the end of the final half-hour, this was not done for fear that the real purpose of the study might become known to *S*s who had not yet participated. After all *S*s had completed the experiment, the questionnaire was mailed to each with a covering letter.

Results

RELIABILITY OF MEMORY CATEGORIES

The reliability of the classification of memories by *E* when tested by a second judge showed a percentage of agreement that ranged between 90% and 100%, with a mean of 96%. The reliability was based upon a tape-recorded sample of 20 memories from each of 11 *S*s taken as every third *S* from the combined groups. Reinforcements were eliminated from this tape to avoid presenting clues to the second judge.

COMPARISON OF OPERANT AND REINFORCEMENT PERIODS

To test the hypothesis that the reinforcing stimulus would increase the proportion of memories in the reinforced category, "family" or "nonfamily," the relative frequency in the operant period was compared to the relative frequency in the reinforcement period. This latter period was defined as that part of the total experimental hour which followed the delivery of the second reinforcement. Table 1 presents the relative frequency of the reinforced category (reinforced memories divided by all memories) for the operant period and for the reinforcement period of each *S*.

For the "family" group, 13 of the 16 *S*s gave a higher proportion of "family" memories after reinforcement. The exact probability of this result for a one-tailed sign test is .01064 (Siegel, 1956). The use of a one-tailed test is appropriate, since the direction of the change is predicted. For the "nonfamily" group, 15 of 18 *S*s gave a higher proportion of "nonfamily" memories after reinforcement. This result has an exact probability of .00377 for a one-tailed sign test.

For the groups combined, a technique suggested by Cronbach (1949, p. 411) was employed. For both groups, the relative frequency of "family" memories in the reinforcement period was plotted as a function of the relative frequency of "family" memories in the operant period. A median was obtained visually for *each* operant level class interval along the baseline and cases in each group falling above and below this median were noted. With

TABLE 1

Relative Frequency of Memories in the Reinforced Category for the Operant Period and for the Reinforcement Period for the Two Experimental Groups

"FAMILY" GROUP				"NONFAMILY" GROUP			
S	Operant	Reinforcement	Change	*S*	Operant	Reinforcement	Change
1	.30	.43	+.13	1	.30	.47	+.17
2	.39	.41	+.02	2	.57	.32	+.25
3	.37	.29	−.08	3	.81	.89	+.08
4	.40	.48	+.08	4	.78	.80	+.02
5	.25	.12	−.13	5	.60	.70	+.10
6	.55	.58	+.03	6	.53	.84	+.31
7	.50	.56	+.06	7	.90	.73	−.17
8	.06	.26	+.20	8	.60	.63	+.03
9	.60	.70	+.10	9	.69	.70	+.01
10	.50	.46	+.04	10	.58	.64	+.06
11	.50	.62	+.12	11	.63	.70	+.07
12	.33	.47	+.14	12	.35	.58	+.23
13	.53	.62	+.08	13	.50	.58	+.08
14	.53	.70	+.17	14	.55	.80	+.25
15	.38	.43	+.05	15	.45	.61	+.16
16	.33	.48	+.15	16	.48	.54	+.06
				17	.18	.33	+.15
				18	.58	.57	−.01

From Quay: The effect of verbal reinforcement on the recall of early memories.

these above and below the median counts combined into a single fourfold table (as if the count had been made in terms of a grand median for *all* cases regardless of operant level), chi square was computed. The obtained value was 12.44, significant at the .001 level for one degree of freedom. Inspection of the scatter plot and the fourfold table indicated that it was cases in the "family" group which more often were above the column medians.

Here it should be noted that while both groups are experimental groups, the mutually exclusive, all-inclusive nature of the memory categories makes them at the same time control groups for each other. For example, if one should argue that the relative frequency of "family" memories would naturally rise as a result of *S* becoming more at ease with *E* as the interview proceeded, then one must explain the drop in relative frequency of "family" memories when "nonfamily" memories were reinforced.

MAGNITUDE OF EFFECT

Inspection of Table 1 indicates further that there were differences in amount of change for those Ss who showed an increase in relative frequency of the reinforced category. Increases ranged from .01

to .31. Since initial operant levels were different for most all of the *S*s, no exact comparisons of these changes are possible. However, no significant Mann-Whitney *U* tests (Siegel, 1956) suggest that these differences are unrelated to either "family" or "nonfamily" group or to initial operant level.

AWARENESS OF SUBJECTS

Of the 30 *S*s who returned the questionnaire regarding awareness, only one individual indicated that he was aware of the contingency between his responses and the reinforcing stimulus. This *S* ranked second in the magnitude of increase in relative frequency under reinforcement. Fifteen of the *S*s indicated that they recognized that *E* had said "uh-huh," yet all 15 denied having been influenced by *E*. Three *S*s indicated that *E* seemed more interested in some topics than others; but none named the topic, and all three denied influence. Eleven of the *S*s apparently had no awareness whatsoever of either *E*'s saying "uh-huh" or of any relationship between this and what they recalled.

DISCUSSION

This study has demonstrated that highly personal and emotionally charged memories can be manipulated by another person in an interview with very minimal verbal participation selectively placed after certain classes of these memories.

While this process of subtle interpersonal influence has not been demonstrated within psychotherapy itself, several considerations lead one to predict that the effect would appear with even greater magnitude over a series of psychotherapeutic interviews. For example, a psychotherapist would have much more time in which to respond selectively, his verbal participation in psychotherapy would be considerably greater than the very minimal reinforcing verbalization used in this study, and it seems very likely that he would have more prestige (Verplanck, 1955b) with his patients than the graduate-student investigator in the role of *E* had with the *S*s in this experiment.

Certain implications for the evaluation of psychotherapeutic success or failure are also suggested by the results of this study. One major point of emphasis in the evaluation of patient improvement has been the changes in the patient's verbal behavior over the course of treatment (Mowrer, Hunt, & Kogan, 1953; Raimy, 1948; Seeman, 1949). While such changes are assumed to be attributable to a restructuring of the personality as a result of insights gained in the psychotherapy, there certainly exists the possibility that a psychotherapist may selectively reinforce these types of statements, increasing their frequency in the later stages of treatment. It is conceivable, however, that such changes of verbalization may constitute genuine therapeutic restructuring, but the validity of such a contention must be tested before it can be accepted.

The question of awareness is an intriguing one in relation to both the patient and the therapist. Many *S*s are able to learn in the verbal conditioning situation without verbalizable awareness of either the presence of the reinforcing stimulus, the response considered "correct," or the contingency between the two. That the therapist may selectively respond outside of his own awareness has already been suggested by Bach (1952). If research within psychotherapy itself demonstrates selective therapist reinforcement of patient verbalizations which make these verbalizations conform more and more to the therapist's theoretical convictions, one might well expect that this process was taking place outside the awareness of both patient and therapist.

SUMMARY

Thirty-four college students were asked to recall events from their early childhood. After a baseline was established in an initial operant period, 16 of the *S*s were reinforced by *E* saying "uh-huh" for memories concerned with members of the *S*'s family. Eighteen of the *S*s were similarly reinforced for memories not concerned with the family. In both groups the reinforcing stimulus served to increase the proportion of memories in the reinforced category when the reinforcement period was compared to the operant period. The results, indicating that personally relevant and emotionally charged materials are subject to manipulation by the use of a minimal reinforcing verbalization, were related to the testing of causal and dynamic hypotheses about personality within the psychotherapeutic interview.

REFERENCES

Bach, G. R. Some diadic functions of childhood memories, *J. Psychol.*, 1952, **33,** 87–98.

Cronbach, L. J. Statistical methods applied to Rorschach scores: A review. *Psychol. Bull.*, 1949, **46,** 393–429.

Greenspoon, J. The effect of verbal and nonverbal stimuli on the frequency of members of two verbal response classes. Unpublished doctoral dissertation, Univer. of Indiana, 1951.

Greenspoon, J. The reinforcing effect of two spoken sounds on the frequency of two responses. *Amer. J. Psychol.*, 1955, **68,** 409–416.

Heine, R. W. A comparison of patient's reports on psychotherapeutic experience with psychoanalytic, non-directive, and Adlerian therapists. *Amer. J. Psychother.*, 1953, **7,** 16–23.

Hunt, J. McV. Psychological services in the tactics of psychological science. *Amer. Psychologist*, 1952, **11,** 608–622.

Mowrer, O. H., Hunt, J. McV., & Kogan, L. S. Further studies utilizing the discomfort-relief quotient. In O. H. Mowrer (Ed.), *Psychotherapy theory and research*. New York: Ronald, 1953. Pp. 257–295.

Quay, H. C. The effect of verbal reinforcement on the recall of early memories. Unpublished doctoral dissertation, Univer. of Illinois, 1958.

Raimy, V. Self-reference in counseling interviews. *J. consult. Psychol.*, 1948, **12,** 153–163.

Seeman, J. A study of the process of nondirective therapy. *J. consult. Psychol.*, 1949, **13,** 157–168.

Sidowski, J. B. Influence of awareness of reinforcement on verbal conditioning. *J. exp. Psychol.*, 1954, **49,** 355–360.

Siegel, S. *Nonparametric statistics for the behavioral sciences*. New York: McGraw-Hill, 1956.

Verplanck, W. S. The control of the content of conversation; reinforcement of statements of opinion. *J. abnorm. soc. Psychol.*, 1955, **51,** 668–676.(a)

Verplanck, W. S. The operant conditioning of human motor behavior. *Psychol. Bull.*, 1955, **53,** 70–82.(b)

Wilson, W. C., & Verplanck, W. S. Some observations on the reinforcement of verbal operants. *Amer. J. Psychol.*, 1956, **64,** 448–451.

41.

Avoidance Conditioning of Verbal Behavior without Awareness: A Paradigm of Repression*[1]

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James L. Kuethe

Several recent experiments have suggested that the principles of learning theory may be profitably applied to the study of language and verbal behavior (2, 4, 6). These studies have shown that the verbal behavior of a subject can be manipulated through the use of differential reinforcement and in many cases the subjects remain unaware that their behavior has been modified, i.e., they are unable to state in what way their behavior has changed or even that it has changed. While these experiments have dealt with overt verbal behavior, it seems reasonable that implicit verbal behavior or thinking might similarly be affected. If so, these experiments have some interesting implications for research on psychological defense mechanisms in that they offer suggestions as to how defenses might be learned and how they might operate.

It is an empirical observation that responses followed by punishment or anxiety tend to be eliminated or replaced by other responses. If thoughts or implicit verbal behavior are considered as responses subject to manipulation by reinforcement, we can expect that thoughts that have become conditioned stimuli for anxiety will be eliminated or replaced by other thoughts. Dollard and Miller (3) have presented a detailed theoretical treatment of defense mechanisms along these lines.

Such a theoretical account of the learning of defense mechanisms would gain support if it could be shown that thoughts or associations that were followed by anxiety were eliminated or replaced. It was our purpose in the present study to determine, first, whether verbal associations could be produced without the S's becoming aware that his behavior had been modified. We also wished to determine if such effects would persist when the experimental task was changed.

Method

The basic technique used in this study was a modified form of the word associa-

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[1] This research was sponsored by Research Grant M-1037 from the National Institute of Mental Health.

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tion test. Here the same set of stimulus words was administered to Ss a number of times in an unbroken sequence. Table 1 shows the 15 stimulus words comprising the association list that was used. It was assumed that each word on this list constituted a stimulus having a hierarchy of associations or responses that had been acquired by S during his life experiences. From a pilot study we had found that when the same word list is repeated a number of times, Ss tend to continue to repeat their original associations. We wished to determine whether strong electric shocks administered every time certain selected associations occurred would result in these responses dropping out and being replaced by other associations.

TABLE 1

STIMULUS WORDS

Careless	Lovely
Perfect	Hasty
Cheerful	Gawky
Tidy	Rural
Rotten	Thrifty
Costly	Old
Small	Boastful
Polite	

From Eriksen and Kuethe: Avoidance conditioning of verbal behavior without awareness: A paradigm of repression.

Prior to beginning the experimental sessions with an S, the *E* randomly designated five of the stimulus words in the list which were to be the critical stimuli for this particular S. During the first trial the S's associations to these five words, whatever they happened to be, were punished by a strong electric shock. Without pause the S was given a second trial on the 15 stimulus words followed by a third trial and so on for a total of ten trials or until the S had reached a criterion of two successive trials without the occurrence of any one of the five punished associations. On each trial the stimulus words occurred in a different sequence. During these succeeding trials on the list, S was administered a strong electric shock every time he responded with one of the five associations that had been shocked on the first trial. Shocks were administered only when these "taboo" associations occurred.

Shocks were administered through ankle electrodes attached to the S's left ankle. The source of the shock came from an inductorium and a 3 v.d.c. source. Faradic stimulation was used. The intensity of shocks varied slightly between Ss due to such factors as differences in skin resistance, but in all cases it was evident from the S's comments and behavior that the shocks were quite painful.

In order to maximize the opportunities for obtaining "learning without awareness," the Ss were misinformed as to the nature of the experiment and the reason for the electric shocks. They were told that the purpose of the experiment was to determine the maximum speed of mental associations. They were instructed that shocks would occur under two conditions: one, if their association to a stimulus word was too slow for that particular stage of practice; and the second was a condition that the *E* could not divulge to them in advance, but they might discover it on their own during the session and thus be able to avoid getting the shocks.

The Ss were instructed to respond to each stimulus word with the first word that came to mind and as quickly as possible. To insure that they understood the nature of the task, several practice words were administered. They were also informed that the same list of words would be repeated over and over, but each time the words would occur in a different sequence. During the experimental session *S*'s association time to each stimulus word was measured to the nearest hundredth of a second by means of an electronic voice key. The timer was started by the sound of *E*'s voice and manually stopped by *E* when *S* responded.

At the conclusion of this learning phase of the experiment, *S*s were informed that this experiment was over and were then asked to do one more task before leaving. This consisted of chained associations to the stimulus words. The *S*s were told that the same stimulus words would be repeated again, but this time they were to say all the words that came to mind and continue doing so until the *E* said "stop." Fifteen seconds were allowed for chained associations to each stimulus word. Before starting this phase of the experiment, *S*s were all carefully instructed that there would be no further electric shocks.

In carrying out the chained associations in this experiment, we were interested in two things. First, we wished to see if the punished association would occur when the *S* was required to give a large number of responses, and second, we were interested in determining if the effects of punishment would be generalized to a situation somewhat different from the original learning situation, in which the threat of shocks had been removed.

At the conclusion of the chained associations the *S* was closely interviewed to determine his ability to verbalize the true nature of the experiment and changes in his behavior. All *S*s were asked the following questions: Did you discover how to avoid getting shocks? Did you do anything to keep from getting shocked? What did you do? Did you ever find yourself withholding a response word and trying to think of something else to say? (If a positive answer was obtained, *S* was asked if he could recall any instances where this occurred.) Those *S*s who reported deliberately withholding responses and substituting other responses for them were also questioned as to whether they had to continue doing this throughout the experiment.

In addition to the questioning, *S*s were shown a list of the stimulus words and asked to indicate which words had been followed by shock and what response word they had given when the shocks occurred.

SUBJECTS

Thirty-one male undergraduate students served as *S*s in the experiment. All were obtained from the elementary psychology course at The Johns Hopkins University. As part of the course requirements, they were required to serve as *S*s in psychological experiments.

Results

AWARENESS

On the basis of the interview data it was possible to divide the *S*s clearly into high- and low-level-of-awareness groups. The high awareness *S*s were able to state the real basis for shocks and to describe what they had done to avoid them. They were also able to identify correctly three or more of the critical stimulus words as well as the response they had given that led to punishment. All reported deliberately withholding punished responses while trying to think of another response to substitute for it. However, they all reported that after a few trials it was no longer necessary to withhold the punished responses deliberately since the new, or safe, response began to occur "automatically."

The low awareness Ss, on the other hand, were unable to state any reasons for the shock other than the misinformation the *E* had given them prior to the experiment. Occasionally they expressed hypotheses that were quite unrelated to the real basis for shock and which were quite at variance with their actual behavior. They were unable to provide an accurate description of changes in their behavior and all stated that they had not learned how to avoid getting shocks. When asked to indicate which of the stimulus words had been followed by shock, their selection was random. In no case were their selections more than 20 per cent correct.

It was possible to classify eleven of the Ss as having a high level of awareness or insight and another eleven Ss as having a low level of insight. There were another five Ss who could not be clearly placed in either the insight or the noninsight group. These Ss seemed to have a vague idea as to the reasons for shock and what they needed to do to avoid them, but their verbalizations were not definite enough to permit clear-cut decisions. We have labeled these Ss as the partial insight group. The remaining four Ss resisted classification on our insight criteria. Three of these Ss had adopted an incorrect hypothesis concerning the shocks. While their hypotheses were incorrect, they were nonetheless effective in avoiding shocks. For example, two of these Ss had the hypothesis that shocks occurred when they gave synonyms and they had changed all of their responses to avoid synonyms. The other two Ss had resorted to using only two response words, such as, "good" and "bad" for all stimulus words. The data from these four Ss were excluded from further analysis.

Since we were successful in obtaining two levels of awareness or insight in our Ss, we have treated insight as an independent variable in the remainder of the data analyses. We have not presented the data for the partial insight group, however, due to the small number of Ss that fell into this group.[3]

AVOIDANCE LEARNING

Both the insight and noninsight groups were quite successful in learning to avoid the punished associations. As Fig. 1 shows, the number of repetitions of punished responses decreases rapidly for both groups while the number of nonpunished responses that were repeated from trial to trial tends to remain constant. For the insight group, a mean of 68.2 per cent of the first-trial, nonpunished response words were repeated on Trial 7 while only 3.6 per cent of the punished responses were repeated on this trial. A *t* test of the difference between these two means resulted in a *t* value of 12.2 which with ten degrees of freedom was significant beyond the .001 level. The same comparison for the noninsight group shows the mean percentage of repetition of the first-trial, nonpunished responses on Trial 7 to be 60.0 per cent as compared with a mean percentage of 10.9 for the punished responses. The t value of 6.21 is again quite significant ($p < .001$).[4]

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[3] In nearly all of the subsequent comparisons it was found that the partial insight Ss were intermediate between the insight and the noninsight groups although their performance more closely resembled that of the insight Ss.

While both the insight and noninsight groups show marked and reliable evidence of avoidance learning in this experimental situation, there does not appear to be any reliable evidence of a difference in rate of learning between these two groups. From Fig. 1, it appears that the noninsight group showed a tendency for more avoidance of shocked responses on Trials 2 through 4, but a t test based upon the mean percentage of shocked responses for each *S* in the two groups summed through these three trials does not approach statistical reliability ($t = 1.42$, $p > .10$). Also the same comparison between the insight and noninsight *S*s on Trials 5 through 7 yields a t of 1.44 which is again insignificant ($p > .10$).

From Fig. 1 it appears that the noninsight group tended to give fewer first-trial responses to the noncritical stimuli than did the insight group. To determine whether this difference was reliable, the mean percentage of first-trial responses given by each *S* on Trials 2 through 7 was computed. The means of these mean percentages were 68.8 for the insight group and 58.8 for the noninsight group. The resulting t of 1.22 with 20 *df* does not approach accepted levels of statistical reliability and we cannot conclude that the two groups differ on the repetition of first-trial associations on subsequent trials.

A further confirmation of the lack of effect of insight upon the rate of avoidance learning is found when we compare the number of trials required by the insight and the noninsight groups to reach the criterion of two successive trials without a repetition of a punished response. The results of this analysis are seen in Table 2. As this table shows, the mean number of trials required for both groups is nearly identical and the t test falls far short of acceptable levels of significance.

REACTION TIMES

While there is no evidence of differences in rate of avoidance learning between the insight and the noninsight *S*s, there are some marked differences between these two groups in reaction times to stimulus words that have had punished responses (critical stimuli). On each trial the median reaction time to critical and noncritical stimuli was computed for each *S*. In Fig. 2 the mean of these median reaction times as a function of number of trials is shown for the insight and the noninsight groups. For the noninsight group the mean reaction times for both the five critical and the ten noncritical stimuli decreases as a function of trials. By the last trial the reaction times are virtually the same for both critical and noncritical words.

For the insight group, however, the rela-

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[4] An over-all analysis of variance of these data was not justified due to the marked heterogeneity of variance that existed from the early to the late trials and the skewness of the distributions on the late trials. The t tests that have been employed here either have been corrected for heterogeneity of variance by the method suggested by Cochran and Cox (1) or the comparisons are between data that show reasonable evidence of meeting the underlying assumptions involved.

As a further precaution all statistical analyses involving percentages in this study were repeated using an arc-sine transformation of the percentages. In no case did the analyses using the transformed data result in significance levels appreciably different from those reported for the untransformed data.

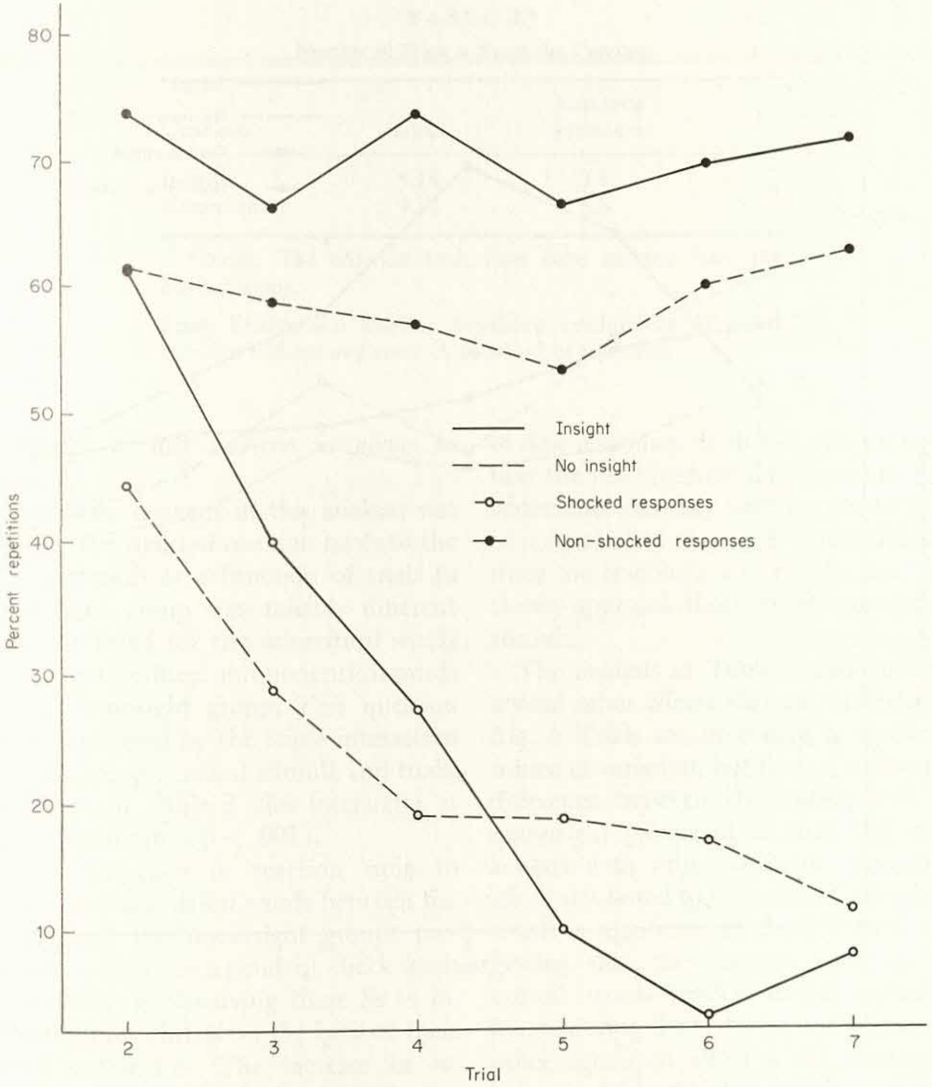

FIG. 1. Percentage of first-trial responses repeated on succeeding trials as a function of punishment. From Eriksen and Kuethe: Avoidance conditioning of verbal behavior without awareness: A paradigm of repression.

tion of reaction times to trials differs for the critical and the noncritical stimuli. The times for the noncritical words decrease with trials as did reaction times for both critical and noncritical words in the noninsight group, but for the critical stimuli there is an initial increase in reaction time. Only on the fourth trial does the mean reaction time to the critical words begin to decrease, and even then it is still longer than the reaction time on the first trial.

In order to evaluate the statistical relia-

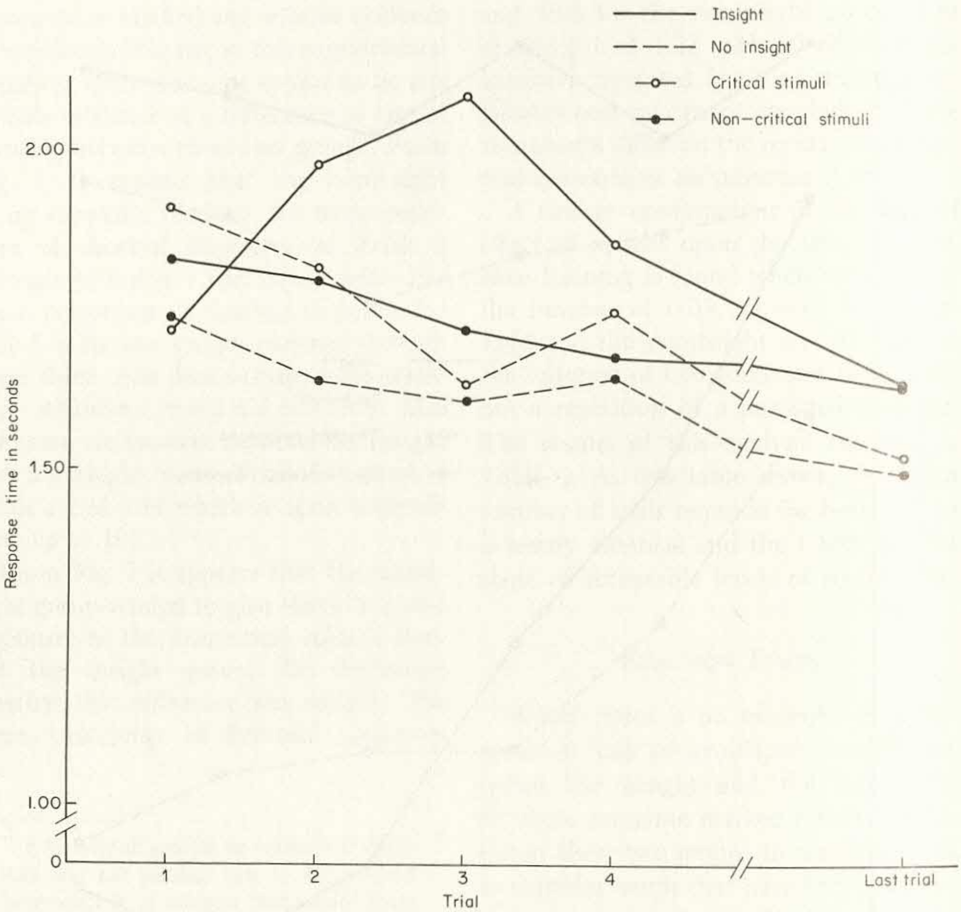

FIG. 2. Reaction times to critical and noncritical stimuli as a function of trials. From Eriksen and Kuethe: Avoidance conditioning of verbal behavior without awareness: A paradigm of repression.

bility of the interaction between insight, trials, and critical words that appears in Fig. 2, a modified four-way analysis of variance (insight, critical stimuli, trials, and *Ss*) was performed. The analysis used was identical to that described by Lindquist as Plan VI (5). The data for this analysis were the median reaction times for critical and noncritical stimuli for each S on each of the first four trials.[5] The

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[5] Only the first four trials were used in this analysis since a number of the *Ss* in both groups had reached the avoidance criterion by the end of the fourth trial.

TABLE 2*

Number of Trials to Reach the Criterion

GROUPS	MEAN	VARIANCE ESTIMATE	t
Insight	4.18	2.8	.09
Noninsight	4.27	6.8	

* Note: The criterion trials have been omitted from the computations.

From Eriksen and Kuethe: Avoidance conditioning of verbal behavior without awareness: A paradigm of repression.

summary of this analysis is given in Table 3.[6]

Our main concern in this analysis was whether the trend of reaction times to the critical stimuli as a function of trials in the insight group was reliably different from the trend for the noncritical words and for both critical and noncritical words in the noninsight group. This question can be answered by the triple interaction between groups, critical stimuli, and trials. As is seen in Table 3, this interaction is highly significant ($p < .001$).

This difference in reaction time to critical and noncritical words between the insight and the noninsight groups provides us with an independent check upon the validity of classifying these Ss as insightful or insightless on the basis of their verbal statements. The increase in reaction time to critical stimuli in the insight group is what might be expected in view of their statements that they deliberately withheld responses that had been punished while they attempted to think of new responses. It should also be noted that the reaction-time data bear out their statements that they soon learned to think of nonpunished responses "automatically" since the reaction times for the last trials closely approach those for the noncritical stimuli.

The analysis in Table 3 also confirms several other effects that are indicated in Fig. 2. Trials are, of course, a significant source of variation, but there is no over-all difference between the insight and the noninsight groups other than the interactions with other variables. The main effect attributed to critical and noncritical words is significant at the .05 level, suggesting that the reaction times to the critical words tended to be somewhat longer during the first four trials. The only other significant effect is the interaction between trials and the insight and noninsight groups. Inspection of Fig. 2 shows that for the insight group, reaction times decreased at a slower rate for the first three trials than did the reaction times for the noninsight group.

CHAINED ASSOCIATIONS

Following the avoidance conditioning on the word-association test, the Ss were

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[6] Bartlett's test for heterogeneity of variance did not reach significance at the .05 level.

TABLE 3

Summary of the Analysis of Variance of the Reaction-Time Data for Trials 1–4

SOURCE	SUM OF SQUARES	*df*	*F* RATIO	*p*
Total	47.32	175		
Trials	1.46	3	.49/.07 = 7.00	<.001
Critical stimuli	1.49	1	1.49/.21 = 7.09	<.05
Insight	1.03	1	1.03/1.36 = .76	>.10
Subjects	27.13	20	1.36/.07 = 19.42	<.001
Trials × critical stimuli	.29	3	.10/.07 = 1.43	>.10
Trials × insight	.95	3	.32/.07 = 4.57	<.01
Critical stimuli × insight	.07	1	.07/.21 = .33	>.10
Trials × critical stimuli × insight	2.06	3	.69/.07 = 9.86	<.001
Within-subject error terms:				
pooled subjects by trials	4.25	60	.07/	
pooled subjects by critical stimuli	4.15	20	.21/	
pooled subjects by trials by critical stimuli	4.44	60	.07/	

From Eriksen and Kuethe: Avoidance conditioning of verbal behavior without awareness: A paradigm of repression.

informed that there would be no more shocks in the experiment. They were then asked to chain-associate for 15 seconds to each of the stimulus words. In Table 4 we have presented a breakdown of the chained association data for the insight and noninsight Ss in terms of mean number of associations and mean number of first-trial response words repeated as a function of critical and noncritical stimuli.

TABLE 4

Comparison of Groups on the Average Number of Chained Associations per Stimulus and the Average Percentage of First-Trial Responses

	MEAN NUMBER OF ASSOCIATIONS		MEAN PERCENTAGE OF FIRST-TRIAL RESPONSES REPEATED	
Groups	Stimuli		Stimuli	
	Critical	Noncritical	Critical	Noncritical
Insight	4.5	4.4	49	74
Noninsight	4.4	4.5	50	66

From Eriksen and Kuethe: Avoidance conditioning of verbal behavior without awareness: A paradigm of repression.

The data on total associations and on percentage of repetitions of the first-trial words were separately analyzed by a modified three-way classification analysis of variance (insight, critical words, and *S*s). The analysis for total associations revealed no significant effects. This is apparent from Table 4. However, the analysis of percentage of repetitions of first-trial responses resulted in one significant effect ($p < .01$). More first-trial responses to noncritical stimuli than to critical stimuli were elicited during chained associations. This finding indicates that the effects of shocks upon the *S*s' associations have persisted despite a somewhat different task and the conscious knowledge that electric shocks will no longer occur.

DISCUSSION

In order to explain the phenomena of repression in terms of the principles used in describing avoidance conditioning and the effects of punishment as Dollard and Miller (3) have done, it is necessary to show that implicit verbal behavior or thoughts are analyzable into stimulus-response sequences. It is also necessary to show that these stimulus-response sequences are learned and modified by the same principles of reinforcement that govern other behavior. In their book, Dollard and Miller have given a plausible treatment of these points.

The results of the present experiment have contributed another step toward an analysis of repression in terms of avoidance conditioning. There are two characteristics of repression that must be demonstrated by any experimental analogue of the repression process. In order for repression to be effective, the anxiety-provoking thought must be prevented from occurring. Thus, the experimental analogue must provide reasonable evidence that the changes in behavior have occurred not only at the overt level but at the covert level as well. Also, since a prominent feature of repression, as clinically observed, is the *S*'s lack of awareness of the repression process, the experimental analogue must demonstrate that the anxiety-provoking thought is eliminated "automatically." That is, the *S* should not have an awareness of having deliberately and intentionally changed his thoughts.

The results of the present experiment seem to meet these two requirements quite well, especially in the case of *S*s in the noninsight group. Not only did these *S*s show a marked and rapid decrease in punished associations, but this dramatic change in their associations occurred without verbal awareness on their part. These *S*s were unable under intensive questioning to describe what they had done to avoid shocks, and they reported no awareness of having deliberately withheld associations in an attempt to think of a new association.

Fortunately we do not have to rely upon the verbal reports of these *S*s alone to support our belief that this avoidance learning occurred without awareness. A comparison of the reaction times for the insight and the noninsight groups lends confirmation to the *S*s' verbal reports. The insight *S*s who had clear verbal awareness of how to avoid shocks and who reported having tried deliberately to withhold punished associations and think up new ones, were found to show an initial increase in reaction times to the critical stimuli for the first three trials. This increase in reaction time is what would be expected to accompany the implicit behavior that these *S*s describe having experienced. For the noninsight group, on the other hand, reaction times to the critical stimuli show a monotonic decrease from the first trial to the last. The reaction times to the critical stimuli in this group are closely comparable to the reaction times to the noncritical stimuli throughout the experiment. The reaction-time data for the critical words in the noninsight group correspond quite well with what would be expected of an "automatic" repression process.[7]

While the verbalizations and the reaction-time data for the noninsight group strongly indicate that avoidance learning had occurred without awareness, these same data also suggest that the behavior changes occurred at the covert as well as at the overt level. Not only do the *S*s from the noninsight group report a lack of withholding of associations, but their reaction-time data also indicate that their overt and covert responses were identical. Had these *S*s implicitly responded with punished associations, it seems likely that their association times would have been appreciably longer to the critical stimuli than to the noncritical stimuli. Actually, however, there was little or no difference in the association times to the two classes of stimuli. Even among the *S*s in the insight group, the reaction times to critical stimuli had become comparable to the reaction times for noncritical stimuli by the last trial. This finding again corresponds with their verbal report that after a few trials the new associations "came to mind automatically" and they no longer thought of the punished responses.

One further piece of evidence that the shocks had effected associations on the implicit level is to be found in the data on the chained associations. Had these punished associations been present in implicit behavior, we would have expected more of them to have attained overt expression when the threat of punishment was removed. Both groups, however, gave fewer of the punished responses during chained association than would be expected on the basis of the number of first trial responses obtained to the noncritical stimuli.

While it was not the purpose of the present experiment to contribute to the theoretical controversy concerning the manner in which punishment eliminates responses, our data seem to favor an interpretation along the lines of an inhibitory process or decrement in the absolute response strength of the punished responses. An increase in response strength of alternative responses alone does not seem adequate to account for the data obtained from chained associations. Here the *S*s had an opportunity to give a relatively large number of responses to each stimulus. Thus, it could be expected that not only would the stronger responses tend to occur, but there was the opportunity for responses lower in the response hierarchy to occur also. Yet only a few punished responses occurred, a result which is all the more surprising since these punished responses were for the most part initially the dominant response in the hierarchy.

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[7] It is interesting to equate the performance of the insight group with the process of conscious suppression and the performance of the noninsight group with the process of repression as these processes are described by Dollard and Miller (3). In both groups the punished responses were successfully avoided, but in the noninsight group the avoidance occurred "automatically" without awareness and without an increase in reaction times. In the insight group, on the other hand, the avoidance was a deliberate conscious act and was accompanied by increased reaction times while these *S*s searched for substitute responses. In the noninsight group the data indicate that the thought itself or the implicit verbal response was initially conditioned while in the insight *S*s the overt verbalization was first conditioned and then the thought or implicit response.

SUMMARY

The Ss were presented with a 15-item word-association list under the guise that they were taking part in an experiment to determine the limit of speed of associations. They were instructed to respond with the first word that came to mind as quickly as possible after the stimulus word was presented. During the first trial on the list, the *E* administered a strong electric shock immediately after five arbitrarily selected response words. The Ss were then given a number of further trials on the same 15 stimulus words. Every time an *S* responded with one of the five first-trial punished responses, he received another electric shock. At the conclusion of this phase of the experiment, Ss were informed that there would be no further shocks. They were then asked to chain-associate to each of the stimulus words.

On the basis of intensive questioning at the conclusion of the experiment, it was possible to classify the Ss into insight and noninsight groups. The insight Ss were characterized by having a high degree of verbal awareness as to the basis for the electric shocks and what they had to do to avoid receiving them. The noninsight Ss had a low level of verbal awareness as to the reasons for the shocks and what they had done to avoid them. Both insight and noninsight groups showed a rapid and marked learning of avoidance behavior. No reliable differences were found between the two groups in terms of rate of learning or on the number of trials to achieve the criterion of two successive trials without the occurrence of a punished response. However, there were clear differences between the two groups in reaction times to stimulus words that had elicited shocked responses. The nature of these differences corresponded with what would be expected from the Ss' verbalization. Both groups showed a significant decrement in the number of punished responses that occurred during chained associations. The relation of these data to a theory of repression was discussed.

REFERENCES

Cochran, W. G., & Cox, Gertrude M. Experimental designs. New York: Wiley, 1950.

Cohen, B. D., Kalish, H. I., Thurston, J. R., & Cohen, E. Experimental manipulation of verbal behavior. *J. exp. Psychol.*, 1954, **47,** 106–110.

Dollard, J., & Miller, N. E. Personality and psychotherapy. New York: McGraw-Hill, 1950.

Greenspoon, J. The reinforcing effect of two spoken sounds on the frequency of two responses. *Amer. J. Psychol.*, 1955, **68,** 409–416.

Lindquist, E. F. Design and analysis of experiments in psychology and education. Boston: Houghton Mifflin, 1953.

Sidowski, J. B. Influence of awareness of reinforcement upon verbal conditioning. *J. exp. Psychol.*, 1954, **48,** 355–360.

42.

Operant Conditioning of Factor Analytic Personality Traits*[1]

Arthur W. Staats, Carolyn K. Staats, William G. Heard, and Judson R. Finley

A. Operant Conditioning

In recent times a number of studies have shown that reinforcement operates according to the principles of operant conditioning to strengthen complex human behavior. Many different types of verbal behavior have been operantly conditioned (Krasner, 1958; Salzinger, 1959). Cohen, et al. (1954), among others have shown that social reinforcers may strengthen a class of verbal responses. In another study (Staats, 1957), a class of verbal responses to a problem solving object was strengthened through a reinforced use of the object in the problem. Scott (1957) has conditioned attitudes through the social reinforcement of winning a debate. Salzinger and Pisoni (1958) have operantly conditioned "affect" statements. Azrin and Lindsley (1956) have operantly conditioned cooperative behavior in children, while Rheingold, Gewirtz, and Ross (1959) have operantly conditioned a component of social responsiveness in infants. Verplanck (1955) has shown that the behavior of stating opinions can be strengthened using verbal stimuli as reinforcers. Cooperative behavior, attitudes, social responsivity and the degree to which an individual is opinionated can be considered to be aspects of personality. Another study (Nuthmann, 1957) has gone a step further toward understanding personality from this approach by showing that responses to a class of statements chosen to indicate acceptance or rejection of self could also be conditioned. Since each statement was presented only once, the success in conditioning indicated the functional unity of this *class* of responses.

The foregoing results suggest that complex human behaviors, which we term personality, may develop according to the principles of operant conditioning. If the ease with which one vouchsafes opinions can be altered in Verplanck's short experimental procedure, it seems reasonable that a life history of reinforcement of opinions would produce an opinionated

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* From A. W. Staats, C. K. Staats, W. G. Heard, and J. R. Finley, Operant conditioning of factor analytic personality traits, *J. gen. Psychol.*, **66**, 101–114 (1962). Reprinted by permission of the authors and The Journal Press.

[1] This study, part of a research project formulated by the first author, was sponsored by the National Institute of Mental Health under Contract M-2381.

"personality." In the same way it is reasonable that a life history of reinforcement for social responsiveness would culminate in a socially responsive person. In addition, the history of reinforcement for statements concerning oneself should also affect the behavior of an individual which we accept as indexing his "self-concept." Keller and Schoenfeld summarize such a general approach with the statement, "There is little reason to resist the conclusion that the personality development of the individual is a function of his own conditioning history" (p. 367). Skinner (1953) has also in a general way discussed the "self" or personality in terms of the principles of operant conditioning.

Further studies are needed to determine whether facets of personality behavior actually are acquired through operant conditioning. Individuals behave in characteristic ways in many different situations. These characteristic ways of behaving are commonly spoken of as reflecting underlying personality traits. Tests have been constructed to measure these traits (or, rather, the covariance of specific behaviors). It is suggested that such measured personality traits have psychological status in that they are functionally unified classes of responses which have been operantly conditioned in the life history of the individual. Following from this, it is suggested that responses to trait items found through factor analysis are such classes of responses. Consequently, response induction would be expected to take place within such responses classes. Thus, strengthening the response to one item through reinforcement should strengthen this type of response to other items in the same trait.

The purpose of the present study is to test this hypothesis. More specifically, the study adapts Nuthmann's procedure to test the experimental hypothesis that responses to factor analytically derived personality trait items (Guilford-Zimmerman traits) can be operantly conditioned as a response class.

B. Experiment I

1. Subjects

The *S*s were 102 introductory sociology students at Arizona State University.

2. Apparatus

The experiment was conducted in a virtually sound-proof room. *S* was seated on one side of a table, *E* on the other side. A partition of ply-wood, painted flat black, was vertically mounted on the table dividing it in such a manner that the *E* and *S* were not visible to each other. The partition had sides which extended back toward the *S* so that his side vision was also restricted. In the center of the partition there was a 2½ × 4½ inch opening for the presentation of 5 × 8 cards on which the trait items were printed. At each end of the *S*'s side of the partition there was a button, one labeled *True* and one labeled *False*. These were used by the *S* to signal his answers to the *E*. Each button activated a light on the *E*'s side of the partition.

3. Materials

The trait of Sociability on the Guilford-Zimmerman was used in this experiment. Since the G-Z trait contains only 30 items and 100 were needed for the procedure, several items were written to be comparable to each G-Z item. Each item was written to capture the same or opposite meaning of the original item, but different words were used. That is, the additional items were written both to mirror the original item and to be the converse. For example, "You find it easy to start conversation with a stranger," is an original G-Z item. Matching items used were, "It is difficult for you to begin talking to a stranger," and "You enjoy making friends with strangers." Seventy of these items were selected to add to the 30 original items.

The 100 items, plus the 40 filler items used by Nuthmann (1957), were then given to a group of 102 Ss. The total scores made on the 30 original items were then correlated with the total scores made on the 70 additional items. The correlation was .89. On the basis of these results, the items were considered to be equivalent for their use in the experiment proper.

The trait items were then randomly assigned to one of five blocks of 20 items with the stipulation that there be 10 true and 10 false keyed responses in each block. The filler items were also randomly assigned to blocks, eight in each block.

4. DESIGN

The 30 Ss scoring lowest on the 100 Sociability trait items were selected for the experiment proper. These Ss were assigned to an Experimental Group and a Control Group in matched pairs, on the basis of their Sociability scores. As a result of the assignment of the matched pairs, the Experimental Group mean was 47.33 and the Control mean was 47.33.

To control the order effect of the presentation of blocks, presentation of item blocks was arranged through use of a systematic 5 × 5 latin square. Five orders of presentations of item blocks were used, each block being presented once at each position in the order. Since there were 15 Ss in each group, three Ss received each order of presentation of blocks, in a replicated latin square design.

5. PROCEDURE

In the procedure each of the 100 items was presented to the *S* in the window of the apparatus. The *S* pressed a button to indicate his *True* or *False* answer. The following instructions were read to the *S*:

> Some time ago in one of your classes you were given a personality test. I am interested in finding out how the different ways of presenting a personality test may cause different answers to be given to it.
>
> Now, you are going to be given the test in a different manner. The statements which you are to answer will be shown on cards in this opening. Read the card and then press the button which indicates your answer to the statement. If your answer is *True*, then press the button marked *True*. If your answer is *False*, then press the button marked *False*. However, be sure to read each statement carefully before you answer. Decide whether the statement is mostly true or mostly false as it concerns you. Then press the appropriate button for a second or so. Do not take too long to decide your answer once you have carefully read the statement. Although many items may seem to be identical, they are not; each item is different. It is not unusual for people to change their answers on personality tests when taking them a second time, so do not worry about being consistent. We are interested in your first impression right now, as you read the card.
>
> Please do not speak out or ask questions until I have indicated the experiment is finished.
>
> We are not interested in individuals as such, but only in the group as a whole. You will be assigned a number and your name discarded, so try to be as honest as you can in giving your answers.

For Experimental Group Ss, each time a response was given which indicated sociability the *E* administered reinforcement by saying *good, very good, that's fine,* etc. Nothing was said to the control *S*.

6. Results

At each block the "sociable" responses to the items were tabulated to determine S's score for the block. In order to control for starting level, the score for the Control S was subtracted from the score of the matched Experimental S, yielding a "difference" score for each matched pair. The curve of the mean difference scores is shown in Figure 1.

Table 1 presents a summary of an Alexander trend analysis (1946) for the difference scores. The basic error term in the analysis was Individual Deviations from Estimation. Line E shows that there were wide differences between Individual Means ($F = 16.49, p < .01$) on the trait of sociability. The ratio of variance due to Group Deviations from Linearity to the error term variance results in an *F* less than 1, allowing the conclusion that there is no systematic fluctuation apart from linear trend. Between Individual Slopes is also of the same magnitude as error, indicating that the slopes of the individual least square straight lines are not significantly different. The critical term in the analysis is Group Slope. The *F* of 5.05 ($p < .05$) indicates that there is a significant linear trend for the whole group, i.e., there is a significant increase in number of sociable responses for the Experimental Group relative to the Control Group.

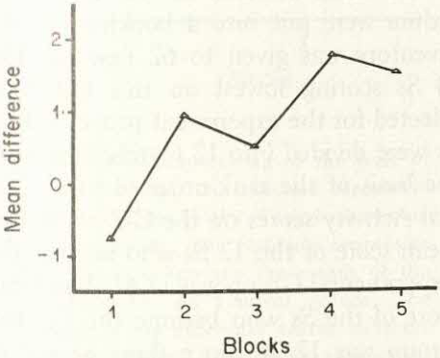

FIG. 1. The conditioning of the trait of sociability. The abscissa represents the order of the blocks of items presented to the subjects. The ordinate represents the difference between the means of the Experimental and Control groups. The increase in the difference scores indicates that Experimental subjects are responding to a greater extent than the Control subjects in the direction of Sociability. The means for the blocks in order were: −.73, 1.00, .47, 1.87, 1.47. From Staats, Staats, Heard, and Finley: Operant conditioning of factor analytic personality traits.

C. Experiment II

1. Subjects

Fifty Ss in an introductory sociology class at Arizona State University were employed in selecting items for use in this experiment. Sixty-two additional introductory sociology students took the complete Guilford-Zimmerman Test. From these test results, the 24 Ss with the lowest scores on the General Activity trait were selected for the experiment proper.

2. Apparatus

The apparatus was the same as was used in Experiment I.

3. Materials

In this experiment the trait of *General Activity* was used in the place of *Sociability*. Thirty-four supplementary items were composed to add to the original 30 items. Twenty-eight from the Guilford-

TABLE 1

Summary of Alexander Trend Analysis of the Difference Scores between Experimental and Control Subjects on Sociability Items

SOURCE OF VARIATION	ERROR TERM	*df*	MEAN SQUARE	*F*
A. Individual deviations from estimation		42	8.24	
B. Group deviation from linearity	A	3	6.55	.79
C. Between individual slopes	A	14	11.95	1.45
D. Group slope	A	1	41.61	5.05*
E. Between individual means	A	14	135.90	16.49**

* $p < .05$.
** $p < .01$.

From Staats, Staats, Heard, and Finley: Operant conditioning of factor analytic personality traits.

Zimmerman which did not involve the General Activity factor were selected for filler items. These items were randomly assigned in constructing a test booklet which was given to the 50 Ss. The correlation between the original and supplementary items was only .69. Because of the low correlation, a *Fan* item analysis (1952) was used to eliminate the eight poorest supplementary items. A new correlation coefficient of .81 was obtained.

Thus, the items which were finally selected for the experiment consisted of the original 30 G-Z General Activity items, plus 26 supplementary items, plus 28 filler items. The 56 General Activity items were randomly assigned to four blocks of 14 items each, with the additional stipulation that there be half *True* keyed items and half *False* keyed items in each block. The 28 filler items were also randomly assigned to the blocks with seven items in each block. These four blocks were then systematically randomized in a 4 × 4 latin square for the order of presentation to the Ss.

4. DESIGN

The items selected in the above procedure were put into a booklet and the inventory was given to 62 new Ss. The 24 Ss scoring lowest on this test were selected for the experiment proper. These Ss were divided into 12 matched pairs on the basis of the rank order of their General Activity scores on the G-Z scale. The mean score of the 12 Ss who became the Experimental Group was 12.42. The mean score of the Ss who became the Control Group was 12.58. Since there were four orders of presentation of the blocks and 12 pairs of Ss, three pairs of Ss were run under each order of presentation in the replicated latin square design.

5. PROCEDURE

The procedure was the same as that used in Experiment I with the exception that only the word *Good* was used as a reinforcing stimulus by the *E*, and this was delivered in a neutral manner. Nothing was said to the Control Ss.

6. Results

The analysis of these results was conducted in essentially the same fashion as in Experiment I. The curve of the difference scores for the operant conditioning of the General Activity trait is shown in Figure 2.

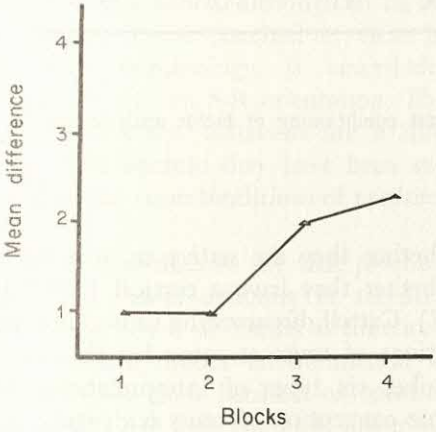

FIG. 2. The conditioning of the trait of general activity. The abscissa represents the order of the blocks of items presented to the subjects. The ordinate represents the difference between the means of the Experimental and Control groups. The increase in the difference scores indicates that Experimental subjects are responding to a greater extent than the Control subjects in the direction of General Activity. The means for the blocks in order were: 1.00, 1.00, 2.00, 2.17. From Staats, Staats, Heard, and Finley: Operant conditioning of factor analytic personality traits.

Table 2 shows the summary of the Alexander trend analysis for the difference scores on the General Activity trait. Using Individual Deviations from Estimation as the error term, Between Individual Means was highly significant ($F = 27.09$, $p < .01$). That there was no systematic fluctuation apart from a linear trend is shown by the non-significant Group Deviations from Linearity term. Since the Between Individual Slopes term was significant at the .05 level ($F = 2.66$), we may conclude that the slopes of the individual least square straight lines were different within the group. For this reason, Between Individual Slopes was used as the error term for testing the significance of Group Slopes variance. The F of 2.26 ($p < .05$) indicates that there was a significant linear trend for the whole group which could not be accounted for by the difference between individuals. The conclusion was, therefore, that a significant increase in the extent of difference between experimental and control *S*s resulted from the conditions of reinforcement for the Experimental Group.

DISCUSSION

The results of the present study are in agreement with other studies which have indicated that classes of verbal responses may be strengthened through the reinforcement of individual members of the response class. In particular, the present experimental results support the contention that responses to classes of personality test items may be operantly conditioned. In the present study, trait items established on the basis of factor analysis were used. It was found that reinforcing one "sociable" response, for example, tended to strengthen other social responses in the Sociability trait. The significant strengthening of sociable responses occurred in the short experimental procedure. It would seem likely that a life history of reinforcement for verbal and motor sociable re-

TABLE 2

Summary of Alexander Trend Analysis of the Difference Scores between Experimental and Control Subjects on General Activity Items

SOURCE OF VARIATION	ERROR TERM	*df*	MEAN SQUARE	*F*
A. Individual deviations from estimation		22	2.03	
B. Group deviation from linearity	A	2	1.00	.49
C. Between individual slopes	A	11	5.4	2.66*
D. Group slope	C	1	12.2	2.26*
E. Between individual means	A	11	55.0	27.09**

* $p < .05$.
** $p < .01$.

From Staats, Staats, Heard, and Finley: Operant conditioning of factor analytic personality traits.

sponses would lead to a strong trait of sociability.

Thus, the results indicated that the Guilford-Zimmerman trait of Sociability, found through factor analysis, is composed of items which form a unified class of responses, i.e., one within which response induction occurs. This suggests that personality traits are classes of responses which develop according to the principles of operant conditioning. In addition, the results also suggest that the psychological processes underlying factors consist of such unified classes of responses.

This latter conclusion has relevance for the various psychological conceptions of factor traits. As has been indicated by Cattell (1946) and Thurstone (1947) there are several ways to consider traits. Thurstone considers interpretations of factors to be assumptions which depend "on one's philosophical preferences and manner of speech, and on how much one already knows about the domain to be investigated . . ." (p. 56). He prefers the approach where, "No assumption is made about the nature of these functions, whether they are native or acquired or whether they have a cortical locus" (p. 57). Cattell discusses the various interpretations of traits at some length and describes six types of interpretations. (a) One conception of traits is dynamic and teleological and considers traits to be "collections of behavior manifestations in which all are directed to the same ultimate biological goal . . . or to some intermediate goal . . ." (p. 63). (*b*) Another interpretation is that the environment molds a cluster of behaviors. "[T]he elements of a social mold trait will covary . . . because a single external influence—e.g., family, school, national culture pattern—has impressed all of them, as from a single focus" (p. 66). Cattell also suggests, "Or, in the terms of one psychological school, the habits have been 'rewarded or punished' in common" (p. 64). (c) [I]n many cases the term is used to refer to a purely logical division of behavior, having no relation whatsoever to any real structures in the typical organism . . ." (p. 66). (*d*) Traits are also considered to be constitutional unities of behavior, and (*e*) Reactions which all emerge together in some developmental process. (*f*) In addition, there are traits for which there is no explanation of the unity of the parts.

It would seem that the different conceptions of traits summarized by Cattell are assumptions, or, perhaps, in Thurstone's terms "philosophical preferences." However, interpretation (*b*), especially, is an hypothesis which, although in its full description is not couched in clear behavioristic terminology, is nevertheless congruent with an S-R orientation. That is, in S-R terms, behaviors are a functional class because they have been subjected to the same conditions of reinforcement.

Cattell continues to say that psychologists have greater difficulty in accepting the interpretation of factors as functional unities arising under environmental influence, (*b*), than because of constitutional traits. He feels the most disturbing limitation comes from the consideration of environmental mold traits as historical unities only, suggesting an absence of prediction to the psychometrist. He attempts to correct this view by saying:

> [T]rait elements formed under one environmental influence are likely to have in common other things than the common variance impressed at the time. Habits formed at the same place and the same age are likely to share reactivity to the same stimuli, to show the same amount of functional autonomy after a certain lapse of time, to follow the same curves of extinction, etc. There are probably as yet unknown similarities through coincidence of place and age in habit formation. . . .
>
> Consequently the environmental mold trait has more than a historical unity—i.e., a unity existing at some time in the past. It will tend to persist and function as a unity. . . . However, these circumstances argue that the environmental mold trait will more frequently than the constitutional trait, appear as a less well-defined or more fragmentary factor (pp. 90–91).

In this discussion, Cattell thus adds further details which agree with an S-R concept of personality traits, for example, his reference to habits "formed at the same place and age are likely to share reactivity to the same stimuli . . ." In S-R terms, it would be said that a class of responses which has been reinforced in the presence of certain stimuli will come under the control of those stimuli.

In summary, several points may be evident from the above: (*a*) psychometrics is interested not only in description for the purpose of predicting later behavior from present behavior, but it is also interested in accounting for the behavior described; (*b*) some of the conjectures made concerning factors are in agreement with an S-R approach; and (*c*) experimental evidence is necessary to support the conjectures made concerning the principles involved in the development of traits.

In this respect, the present experiment produced evidence that certain functional unities as described by mathematical unities of covariation, may be considered to be classes of responses developed according to the principles of operant conditioning. Thus, it is found that the psychometric approach and the experimental S-R approach can be considered to have a complementary relationship at this point. These conclusions suggest, further, that S-R principles and methods can be extended to the psychometric study of factors in a way which may put psychological meat on psychometric's descriptive bones, i.e., discover the principles relating certain determinants to the development, consistency, and change of "traits" of behavior. It is suggested that such an extension of S-R principles will provide some of the theories of factors with the support of experimental evidence. In addition, the principles of trait development, once found, should introduce an element of control into the developmental situation not obtained from the study of S-R laws.

The qualification will no doubt arise that this study has increased the strength of verbal responses through the systematic application of reinforcement, but that this may not pertain to the actual "trait" of sociability. That is, the person may in the experimental situation make sociable verbal responses, but will he become more sociable as a result of the experimental treatment? The first answer to this qualification should be that this is an empirical question. Experiments should be conducted to ascertain if strengthening verbal responses affects other behavior of an individual.

There are, however, some points from other approaches that can be brought to bear on this question. First, psychotherapy is a procedure which is conducted primarily upon a verbal level. The client speaks to the therapist, the therapist verbally responds to the client, sometimes with responses which have reinforcing value. The client's verbal behavior changes in this procedure and it is assumed that this results in appropriate changes in the client's extra-therapeutic behavior. It might also be assumed that in studies indicating change in verbal behavior on tests (e.g., Kaufman, 1950), the change is a resultant of the reinforcement conditions during therapy.

In addition, experiments have been conducted which indicate the general relationship between language responses and their motoric counterparts. For example, the availability of a verbal response has been shown to be predictive of the availability of a corresponding instrumental response (Saugstad, 1952; Judson, Cofer, and Gelfand, 1956). It has also been shown that reinforcing an instrumental response results in strengthening a corresponding verbal response hierarchy (Staats, 1957).

Lest this appear to oversimplify a complicated situation, it should also be pointed out that it has also been generally observed that verbal behavior and motoric behavior are frequently discrepant. In the clinical situation this is recognized in the statement that verbal responses in therapy may occur only on an intellectual level, and thus may not indicate real changes in the client. Therefore, it is said, verbal behavior must indicate changes on an emotional level, if therapy is to be successful. . . .

At this point, however, it should be apparent that this type of rationale has not yet been detailed satisfactorily in considering (*a*) why verbal response classes operantly condition, i.e., why response induction occurs in diverse verbal responses; (*b*) why generalization sometimes takes place from verbal response to motor response; and (*c*) why the generalization sometimes does not take place. It is thus clear, in line with the previous conclusion that S-R principles could be applied to an understanding of factors, that while S-R theoretical conceptions of personality traits need to be developed in much greater detail, at this point they appear to outline a most promising approach to the long-standing problems involved.

REFERENCES

1. Alexander, H. W. A general test for trend. *Psychol. Bull.*, 1946, **43,** 533–557.
2. Azrin, N. H., & Lindsley, O. R. The reinforcement of cooperation between

children. *J. Abnorm. Soc. Psychol.*, 1956, **52,** 100–102.

3. Cattell, R. B. Description and Measurement of Personality. London: Harrap, 1946.
4. Cohen, B. D., Kalish, H. I., Thurston, J. R., & Cohen, E. Experimental manipulation of verbal behavior. *J. Exp. Psychol.*, 1954, **47,** 106–110.
5. Fan, Chung-Teh. Item Analysis Table. Princeton, New Jersey: Testing Service, 1952.
6. Judson, A. J., Cofer, C. N., & Gelfand, S. Reasoning as an associative process: II. Direction in problem solving as a function of prior reinforcement of relevant responses. *Psychol. Rep.*, 1956, **2,** 501–507.
7. Kaufman, P. Changes in the Minnesota Multiphasic Personality Inventory as a function of psychiatric therapy. *J. Consult. Psychol.*, 1950, **14,** 458–464.
8. Keller, F. S., & Schoenfeld, W. N. Principles of Psychology. New York: Appleton-Century-Crofts, 1950.
9. Nuthmann, A. M. Conditioning of a response class on a personality test. *J. Abnorm. Soc. Psychol.*, 1957, **54,** 19–23.
10. Rheingold, H. L., Gewirtz, J. L., & Ross, H. W. Social conditioning of vocalizations in infants. *J. Comp. Physiol. Psychol.*, 1959, **52,** 68–73.
11. Salzinger, K. Experimental manipulation of verbal behavior: a review. *J. Gen. Psychol.*, 1959, **61,** 65–94.
12. Salzinger, K., & Pisoni, S. Reinforcement of affect responses of schizophrenics during the clinical interview. *J. Abnorm. Soc. Psychol.*, 1958, **57,** 84–90.
13. Saugstad, Per. Problem solving as dependent upon availability of functions. Unpubl. Doctoral dissertation, Univ. Chicago, 1952.
14. Scott, W. A. Attitude change through reward of verbal behavior. *J. Abnorm. Soc. Psychol.*, 1957, **55,** 72–75.
15. Skinner, B. F. Science and Human Behavior. New York: MacMillan, 1953.
16. Staats, A. W. Verbal and instrumental response hierarchies and their relationship to human problem solving. *Amer. J. Psychol.*, 1957, **70,** 442–446.
17. Thurstone, L. L. Multiple-Factor Analysis. Chicago: Univ. Chicago Press, 1947.
18. Verplanck, W. S. The control of the content of conversation. *J. Abnorm. Soc. Psychol.*, 1955, **51,** 668–676.

43.

Positive Reinforcement and Behavioral Deficits of Autistic Children*

Charles B. Ferster

Infantile autism, first described by Kanner (6), is a very severe psychotic disturbance occurring in children as young as 2 years. At least outwardly, this childhood schizophrenia is a model of adult schizophrenia. Speech and control by the social environment are limited or absent; tantrums and atavistic behaviors are frequent and of high intensity; and most activities are of a simple sort, such as smearing, lying about, rubbing a surface, playing with a finger, and so forth. Infantile autism is a relatively rare form of schizophrenia and is not important from an epidemiological point of view. The analysis of the autistic child may be of theoretical use, however, since his psychosis may be a prototype of the adult's; but the causal factors could not be so complicated, because of the briefer environmental history. In this paper, I should like to analyze how the basic variables determining the child's behavior might operate to produce the particular kinds of behavioral deficits seen in the autistic child. To analyze the autistic child's behavioral deficits, I shall proceed from the general principles of behavior, derived from a variety of species, which describe the kinds of factors that alter the frequency of any arbitrary act (3, 10). The general principles of behavior applied to the specific situations presumably present during the child's developmental period will lead to hypotheses as to specific factors in the autistic child's home life which could produce the severe changes in frequency as well as in the form of his behavior. As an example, consider the effect of intermittent reinforcement, many of the properties of which are comparatively well known from animal experiments. To find how intermittent reinforcement of the autistic child's behavior might produce deficits, we would first determine, in the general case, what specific orders of magnitude and kinds of schedules produce weakened behavioral repertoires. The factors in the child's home life could be examined to determine estimates of what kind of circumstances could conceivably cause schedules of reinforcement capable of the required attenuation of the child's behavior. The analysis will emphasize the child's performance as it is changed by, and affected in, social and nonsocial environment. As in most problems of human behavior, the major datum is the frequency of occurrence of the child's behavior. Although the account of the autistic child's development and performance is not derived by manipulative experiments, it may still be useful to the extent that all of the terms of the analysis refer to potentially manipulable conditions in the child's environment and directly measurable aspects of his performance. Such an analysis is even more useful if the performances and their effects on the environment were described in the same general terms used in systematic accounts of behavior of experimental psychology.

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* From C. B. Ferster, Positive reinforcement and behavioral deficits of autistic children, *Child Development*, **32,** 437–456 (1961). Reprinted by permission of the author and the Society for Research in Child Development.

Some of our knowledge of the autistic child's repertoire must necessarily come from anecdotal accounts of the child's performance through direct observation. Although such data are not so useful as data from controlled experiments, they can be relatively objective if these performances are directly observable and potentially manipulable. A limited amount of experimental knowledge of the dynamics of the autistic child's repertoire is available through a program of experiments in which the autistic child has developed a new repertoire under the control of an experimental environment (5). These experiments help reveal the range and dynamics of the autistic child's current and potential repertoires. In general, the autistic child's behavior will be analyzed by the functional consequences of the child's behavior rather than the specific form. The major attempt will be to determine what specific effects the autistic child's performance has on that environment and how the specific effects maintain the performance.

Specification of the Autistic Child's Performance

We must first describe the current repertoire of the autistic child before we can describe possible environmental conditions that might produce gross behavioral deficits. A topographic description of the individual items of the autistic child's repertoire would not, in general, distinguish it from the repertoires of a large number of functioning and nonhospitalized children, except perhaps in the degree of loss of verbal behavior. The autistic child's behavior becomes unique only when the relative frequency of occurrence of all the performances in the child's repertoire is considered. In general, the usual diagnostic categories do not adequately characterize the children in the terms of a functional analysis of behavior. Hospitalization of a child usually depends upon whether the parent can keep the child in the home, rather than a functional description of the role of the parental environment in sustaining or weakening the child's performance.

RANGE OF PERFORMANCES

Although the autistic child may have a narrower range of performances than the normal child, the major difference between them is in the relative frequencies of the various kinds of performances. The autistic child does many things of a simple sort—riding a bicycle, climbing, walking, tugging on someone's sleeve, running, etc. Nevertheless, the autistic child spends large amounts of time sitting or standing quietly. Performances which have only simple and slight effects on the child's environment occur frequently and make up a large percentage of the entire repertoire, for example, chewing on a rubber balloon, rubbing a piece of gum back and forth on the floor, flipping a shoelace, or turning the left hand with the right. Almost all of the characteristic performances of the autistic child may be observed in nonhospitalized children, but the main difference lies in the relative importance of each of these performances in terms of the total repertoire. Conversely, isolated instances of quite "normal" performances may be seen in the autistic child. Again, the relative frequency of the performances defines the autistic child.

SOCIAL CONTROL OVER THE CHILD'S PERFORMANCE

The major performance deficits of the autistic child are in the degree of social control: The kinds of performances which have their major effects through the mediation of other individuals.

The main avenue of social control in a normal repertoire is usually through speech, a kind of performance that is unique because it produces the consequences maintaining it through the mediation of a second person (12). Autistic children almost always have an inadequately developed speech repertoire, varying from mutism to a repertoire of a few words. Even when large numbers of words are emitted, the speech is not normal in the sense that it is not maintained by its effect on a social environment. When normal speech is present, it usually is in the form of a *mand* (12). This is a simple verbal response which is maintained because of its direct reinforcement, e.g., "Candy!" "Let me out." The main variable is usually the level of deprivation of the speaker. It lacks the sensitive interchange between the speaker and listener characteristic of much human verbal behavior, as for example, the *tact* (*see* below). The reinforcement of the mand largely benefits only the speaker. In the case of the autistic child, it frequently affects the listener (parent), who escapes from the aversive stimulus by presenting a reinforcing stimulus relevant to the child's mand. At suppertime, the child stands at the door screaming loudly and kicking the door because the ward attendants in the past have taken the child to supper when this situation became aversive enough. Sometimes, the form of the mand is nonvocal, although still verbal, as when the mand involves tugging at a sleeve, pushing, or jostling. The dynamic conditions which could distort the form of a mand into forms most aversive to a listener will be described below. In contrast to the mand, the tact (12) is almost completely absent. This form of verbal behavior benefits the listener rather than the speaker and is not usually relevant to the current deprivations of the speaker. This is the form of verbal behavior by which the child describes his environment, as, for example, "This is a chair"; "The mailman is coming." This latter kind of verbal control is generally absent or weak, as with other kinds of verbal behavior except an occasional mand.

Atavisms

Tantrums, self-destructive behavior, and performances generally aversive to an adult audience are relatively frequent in the autistic child's repertoire. Most autistic mands depend on an aversive effect of the listener for their reinforcement. To the extent that social behavior is present at all, its major mode is through the production of stimuli or situations which are aversive enough so that the relevant audience will escape or avoid the aversive stimulus (often with a reinforcer). For example, on the occasion of candy in the immediate vicinity, the child screams, flails about on the floor, perhaps striking his head, until he is given some candy. There is evidence that much of the atavistic performance of the autistic child is operant, that is, controlled by its consequence in the social environment. The operant nature of the autistic child's atavisms is borne out by experiments where a child was locked in an experimental space daily for over a year. There was no social intervention, and the experimental session was usually prolonged if a tantrum was underway. Under these conditions, the frequency of tantrums and atavisms declined continuously in the experimental room until they all but disappeared. Severe tantrums and attempts at self-destruction still occurred when sudden changes in the conditions of the experiment produced a sudden change in the direction of nonreinforcement of the child's performances. Severe changes in the reinforcement contingencies of the experiment produced a much larger reaction in the autistic than in the normal child. Consequently, we learned to change experimental conditions very slowly, so that the frequency of reinforcement remained high at each stage of the experiment. Much of the atavistic behavior of the autistic child is maintained because of its effect on the listener.

Reinforcing Stimuli

The reinforcers maintaining the autistic child's performance are difficult to determine without explicit experimentation. Small changes in the physical environment as, for example, direct stimulation of the mouth, splashing water, smearing a sticky substance on the floor, breaking a toy, or repeated tactile sensations, appear to sustain the largest part of the autistic child's repertoire. Nevertheless, these may be weak reinforcing stimuli which appear to be strong, because the response produces its reinforcement continuously and because alternative modes of responding are also maintained by weak reinforcers. The durability and effectiveness of a reinforcer can usually be determined best by reinforcing the behavior intermittently or by providing a strong alternative which could interfere with the behavior in question. In the controlled experiments with autistic children, most of the consequences we supplied to sustain the children's performance, such as color wheels, moving pictures, music, and so forth, were very weak reinforcers compared with food or candy. Food generally appeared to be an effective reinforcer, and most of the performances associated with going to the dining room and eating are frequently intact. In contrast, the normal children could sustain very large amounts of behavior through the nonfood reinforcements. It is difficult to guess the potential effectiveness of new reinforcers, because the estimate depends upon some performance being maintained by that reinforcer.

In the everyday activities of the autistic children, little behavior was sustained by conditioned or delayed reinforcers. But, in a controlled experimental situation, such activities could be sustained by explicit training. For example, (a) The sound of the candy dispenser preceding the delivery of candy served as a conditioned reinforcer. The fine-grain effects of the schedules of reinforcement show this. The difference in performance produced by two different schedules of reinforcement could have occurred only if the effective reinforcer were the sound of the magazine rather than the delivery of a coin. The actual receipt of the coin or food is much too delayed to produce the differences in performances under the two schedules without the conditioned reinforcer coming instantly after a response. (b) With further training, the delivery of a coin (conditioned reinforcer) sustained the child's performances. The coin, in turn, could be used to operate the food or nonfood devices in the experimental room. (c) Still later, coins sustained the child's performance even though they had to be held for a period of time before they could be cashed in. The child worked until he accumulated five coins, then he deposited them in the reinforcing devices. (d) Even longer delays of reinforcement were arranged by sustaining behavior in the experimental room with a conditioned reinforcer as, for example, a towel or a life jacket which could be used later in the swimming pool or in water play after the experimental session terminated. The experimental development of these performances shows that, even though the usual autistic repertoire is generally deficient in performances sustained by conditioned reinforcement and with delay in reinforcement, the children are potentially capable of developing this kind of control.

Little of the autistic child's behavior is likely to be maintained by generalized reinforcement, that is, reinforcement which is effective in the absence of any specific deprivation. A smile or parental approval are examples. The coins delivered as reinforcements in the experimental room are potentially generalized reinforcers, since they make possible several performances under the control of many different deprivations. However, we do not know whether the coin has actually acquired the properties of a generalized reinforcer.

STIMULUS CONTROL OF BEHAVIOR

It is very difficult to determine the stimulus and perceptual repertoire of autistic children. When a child responds to a complex situation, it is not usually clear what aspect of the situation is controlling the child's behavior. In most cases, it is difficult to determine to what extent these children can respond to speech discriminatively, since the situations are usually complex and many stimuli may provide the basis for the simple performances. Similarly with visual repertoires. Controlled experiments showed unequivocally that behavior can come under the control of simple stimuli when differential effects of the performances were correlated with the different stimuli. When a coin was deposited in a lighted coin slot, it operated the reinforcing device. Coins deposited in unlighted slots were wasted. The children soon stopped putting coins in the unlighted slots. The previously developed stimulus control broke down completely when these stimuli were placed in a more complicated context, however. A new vending machine was installed with eight columns, eight coin lights, and eight coin slots, so the child could choose a preferred kind of candy. The slight increase in complexity disrupted the control by the coin light, and it took several months and many experimental procedures before the stimulus control was reestablished. A better designed procedure, in view of the minimal perceptual repertoire of these children, would have been a gradual program by which variations in the specific dimensions of the coin slot and coin light were changed while the reinforcement contingency was held constant in respect to the essential property.

In summary, the repertoire of the autistic child is an impoverished one. Little is known about the perceptual repertoire, but the available evidence suggests that it is minimal. The absolute amount of activity is low, but this deficit is even more profound if the specific items of activity are evaluated in terms of whether they are maintained by significant effects on a social or even nonsocial environment. Most of the child's performances are of a simple sort, such as rubbing a spot of gum back and forth, softening and twisting a crayon, pacing, or flipping a shoelace. Those performances in the child's repertoire having social effects frequently do so because of their effects on the listener as aversive stimuli. Atavisms and tantrums are frequent.

The Emergence of Performance Deficits during the Early Development of the Autistic Child

Having characterized the autistic child's repertoire, the next step is to determine the kinds of circumstances in the early life of these children which could bring about the behavioral deficits. The general plan is to state how the major behavioral processes and classes of variables can drastically reduce the frequency of occurrence of the various behaviors in the repertoire of any organism. Then, the parental environment will be examined to determine circumstances under which the actual contingencies applied by the parental environment to the child's behavior could weaken the child's performance similarly. The datum is the frequency of occurrence of all of the acts in the child's repertoire, and the independent variables are the consequences of these acts on the child's environment, particularly the parental environment. All of the terms in such a functional analysis are actually or potentially directly observable and manipulable. In general, the performances in the child's repertoire will be simultaneously a function of many factors, each contributing to changes in the frequency of the relevant performances. It is important, therefore, to consider relative changes in frequency rather than simple presence or absence of various performances. The datum is the frequency of occurrence of the behavior. In the same vein, singly identifiable factors may be interrelated and functioning simultaneously.

The major paradigm for describing the behavior of an organism is to specify the consequences of the act (reinforcement) which are responsible for its frequency. In this sense, the major cause of an instance of behavior is the immediate effect on the environment (reinforcement). The continued emission of the verbal response "Toast" depends on its effect on the parent in producing toast. Every known behavioral process influencing the frequency of a positively reinforced performance is relevant to the problem of defining conditions under which we may produce a behavioral deficit. Given the variables which maintain it, a performance may be weakened by their absence or by changing the order of magnitude. It is perhaps surprising to discover that large behavioral deficits are plausible without any major appeal to punishment or suppression of behavior by aversive stimuli.

INTERMITTENT REINFORCEMENT AND EXTINCTION

Intermittent reinforcement and extinction are the major techniques for removing or weakening behavior in a repertoire. The most fundamental way to eliminate a kind of behavior from an organism's repertoire is to discontinue the effect the behavior has on the environment (extinction). A performance may also be weakened if its maintaining effect on the environment occurs intermittently (intermittent reinforcement).[1] Behaviors occurring because of their effects on the parent are especially likely to be weakened by intermittent reinforcement and extinction, because the parental reinforcements are a function of other variables and behavioral processes usually not directly under the control of the child. The reinforcement of the verbal response, "Give me the book," may go unreinforced because of many factors which determine the behavior of the listener. He may be preoccupied, listening to someone else, disinclined to reinforce, momentarily inattentive, etc. In contrast, the physical environment reinforces continuously and reliably. Reaching for a book is usually followed by the tactile stimulation from the book. Verbal behavior, particularly, depends entirely for its development and maintenance on reinforcements supplied by an audience (usually a parent). Because of the possibility of prolonged extinction and infrequent, intermittent reinforcement, speech and social behavior are the most vulnerable aspects of the child's repertoire. The young child is particularly vulnerable to the extinction and intermittent reinforcement occurring in social reinforcement because only the parental environment mediates nearly all of the major reinforcers relevant to his repertoire. Large parts of the child's repertoire are reinforced by first affecting a parent who in turn produces the reinforcer for the child. The 2-year-old child who asks for a cookie from a parent and gets no response usually has no alternative audience who will reinforce this vocal behavior. The result will either be the extinction of the child's verbal behavior or the reinforcement of nonvocal verbal forms when the child produces a cookie by a tantrum from which the parent escapes by giving the cookie.

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[1] The reader may suggest at this point an apparent contradiction with the fact that extinction after intermittent reinforcement is more prolonged than after continuous reinforcement. This aspect of intermittently reinforced behavior's durability is not a general proposition, however, and does not hold for behavior which is still being maintained. Behavior reinforced intermittently will, in general, be emitted less frequently and be more easily weakened by emotional factors, changes in deprivation, punishment, and physiological disturbances than continuously reinforced behavior.

FACTORS IN THE PARENTAL REPERTOIRE AFFECTING THE FREQUENCY OF REINFORCEMENT OF THE CHILD'S PERFORMANCES

To find the conditions under which the child's repertoire will be weakened, therefore, we must look for conditions influencing the parents' behavior, which will alter the parental performances, in turn providing reinforcement of the child's performances. These might be:

1. The general disruption of the parental repertoire. Any severe disruption of the parental repertoire will severely affect the frequency with which the parent reinforces the behavior of the child. Consider, for example, the depressed parent whose general level of behavior is very low. One consequence of this low level of behaving will be a lessened frequency of reacting to the child. Therefore, many items in the child's repertoire will be less frequently reinforced in the depressed than the normal parent. The verbal responses, "May I have some bread" or "I want to go outside," might go unreinforced or be emitted many times without reinforcement. Various kinds of somatic disturbances, such as alcoholic "hangover," drug addiction, severe headache, somatic diseases, etc., could also produce large changes in the over-all reactivity of the parent to a child. To the extent that the child's performances occur because of their effect on the parent, the severely weakened parental repertoire may correspondingly weaken the child's behavior. If the parental extinction of the child's behavior is systematic and periodic, much of a child's behavior could be eliminated.

2. Prepotency of other performances. Whether or not a parent reinforces a child's performance also depends upon the alternative repertoire available to the parent. For example, the parent who is absorbed in various kinds of activities such as housecleaning, a home business, social activities and clubs, active telephoning, and so forth, may at various times allow many usually reinforced performances to go unreinforced. In general, the likelihood of omitting reinforcement would depend upon the strength of the prepotent repertoire. As an example of a prepotent repertoire, the housewife absorbed in a telephone conversation will not be inclined to answer a child or comply with a request. Housecleaning might be another repertoire controlling some parents' behavior so strongly that it is prepotent over behavior in respect to the child. In both cases, the essential result is the nonreinforcement of the child's behavior in competition with the prepotent

parental repertoire. Mothers of autistic children often appear to have strong repertoires prepotent over the child. This may be at least a partial reason why mothers of autistic children are so often well-educated, verbal, and at least superficially adequate people.

3. A third factor producing intermittent reinforcement of the child's behavior is related to the first two factors listed above. If the parent finds other reinforcers outside of the home more rewarding than dealing with the child, the child becomes an occasion on which the significant elements of the parental repertoire cannot be reinforced. A parent changing diapers, or otherwise taking care of a child, cannot telephone a friend, be out socializing, be on a job, or doing whatever the autistic mother finds rewarding. The child acquires the properties of a conditioned aversive stimulus because it is an occasion which is incompatible with the parents' normal repertoire. This is of course the major method of aversive control in human behavior—the discontinuation of positive reinforcement. Another basis for establishing the child as a conditioned aversive stimulus to the parent is the emergence of atavisms and a large degree of aversive control of the parent by the child. To the extent that the parent is reinforced by escaping from the child because of his conditioned aversive properties, the frequency of the parental reinforcement of the child's behavior is further reduced.

The development of the atavistic behavior in the child by the parent is necessarily a very gradual program in which the beginning steps involve small magnitudes of behavior such as whining, whimpering, and crying. As the parent adapts to these or becomes indifferent to them because of the prepotence of other kinds of activity, then progressively larger orders of magnitude become reinforced. The large-magnitude tantrūm may be approximated or "shaped" by gradual differential reinforcement. The parents of one autistic child, for example, at one period took turns all night standing in the child's room because one step out of the room would immediately produce a severe tantrum in the child. When the child functions as a conditioned aversive stimulus for the parent, the parent is less likely to reinforce the child's behavior positively. This lack of positive reinforcement, in turn, emphasizes the atavistic responses on the child's part as the major mode of affecting the parent.

The usual limiting factor in preventing excessive development of tantrums is the emergence of self-control on the part of the parent in escaping from the aversive control by the child rather than reinforcing it. Here, again, the repertoire of the parent is relevant. The development of self-control requires a highly developed repertoire which depends for its development on the ultimate aversive consequences of the child's control of the parent. The child's control becomes more aversive to the parent if it interrupts strong repertoires. Specifically, a parent engrossed in a conversation will find a child's interruption more aversive than a parent who is simply resting. If, in fact, there is no strong behavior in the parent, then the child's control is not likely to be aversive, and there is no basis for developing self-control.

All three of the above factors—over-all disturbances in the parental repertoire, prepotent activities, and escape from the child because of his aversiveness—reduce the amount of parental reinforcement of the child's performances. The over-all effect of the nonreinforcement on the repertoire of the child will depend upon the length of time and number of items of the child's repertoire that go unreinforced, as well as the existence of other possible social environments that can alternatively maintain the child's behavior (see below).

Differential Reinforcement of Atavistic Forms of Behavior by the Parent

The schedule by which the parent reacts to the child is also relevant to the development of atavistic behavior. Initially, a tantrum may be an unconditioned consequence of parental control as, for example, sudden nonreinforcement or punishment. Eventually, however, the child's tantrums may come to be maintained by their effect on the parental environment, because they present an aversive situation that can be terminated if the parent supplies some reinforcer to the child. The reinforcer presented by the parent to escape from the aversive consequences of the tantrum also increases the subsequent frequency of atavistic responses.

The effect on the parent of the given form and intensity of tantrums will vary from time to time, depending on the conditions maintaining the parents' behavior. This variation in sensitivity of the parent to aversive control by the child results in a variable-ratio schedule of reinforcement of the child's tantrum by the parent—a schedule of reinforcement potentially capable of maximizing the disposition to engage in tantrums. This is the schedule of reinforcement that produces the high frequencies of performances as in gambling (10). The sensitivity of the parent to aversive control by the child will depend on the general condition of the parental repertoire as discussed above. The same factors in the parental repertoire that tend to produce nonreinforcement of the child's behavior—general disruption of the parent or other behaviors prepotent over the child—correspondingly produce reinforcement of large-order-of-magnitude tantrums. The parent whose total repertoire is severely enough disrupted to interfere with the normal reinforcement of the child's behavior will also react only to tantrums that are of large order of magnitude of aversiveness. A range of sensitivity of the parent to aversive control by the child produces ideal conditions for progressively increasing the intensity or frequency of tantrums. A high sensitivity to aversive control guarantees that some tantrums will be reinforced at least periodically. A low sensitivity differentially reinforces tantrums of large orders of magnitude. At one extreme, the parent may be hypersensitive to the child and, at other times, so depressed that only physical violence will produce a reaction. The schedule by which the parent's behavior terminates the tantrum is a second factor which will increase the range of reactivity of the parent. As more behavior is required of the parent to terminate the tantrum, the parent's inclination to do so will fall. When the parent is less inclined to reinforce a given intensity of tantrum, any variation in tantrum intensity is tantamount to differential reinforcement of extreme forms, if the parent now reacts to the larger-order-of-magnitude tantrum.

How much the parent differentially reinforces tantrums in the child depends, in part, upon the child's other positively reinforced repertoires. When, for example, a child's performance suddenly goes unreinforced, as when a parent may refuse a request, the likelihood and severity of a tantrum will in part depend on the parent's ability to "distract" the child. This, in turn, depends upon whether alternative modes of behavior are in fact available to the child. When conditions are present for the progressive reinforcement of more and more severe tantrums, the process is potentially non self-limiting. Autocatalysis is likely to occur, particularly if the parent has little disposition to reinforce the general items in the child's repertoire for reasons other than terminating the aversive demands of the child.

Nonsocial Reinforcers

Some of the child's behavior is maintained by his direct effect on the physical environment without the intervention of other individuals. In general, very small effects on the environment will sustain performances with which the parent usually has little reason to interfere. For example, the child plays with his own shoelace, moves his fingers in his own visual field, emits minimal nonverbal, vocal responses, and so forth. Larger effects on the physical environment as, for example, moving objects about the house, speaking to the parent, playing with toys, touching and handling usual household objects, are more likely to enter upon the parental repertoire and so may produce a response whose effect is to discontinue the behavior or interfere with its reinforcement. The punishment aspect of the parental interference with the child's activities will be dealt with separately below. The relative possibility of parental interference and nonreinforcement of the hierarchy of performances may account for the large part of the autistic child's repertoire, which consists of behaviors having small, limited effects on the physical environment. Occasionally, even behaviors that are maintained by the most simple effects on the environment are extinguished or punished when they occur in the presence of a parent. For example, the father of one autistic child reports that the child reached for a chandelier while he was holding him. The father instantly dropped the child, with a reaction of considerable disapproval because "You should pay attention to me when you're with me." Aside from the secondary effect on the child, the immediate result of the incident is the nonreinforcement of the child reaching for a common physical object.

The existence of "nonverbal" vocal behavior in some autistic children may be related to forms of vocal behavior with which the parent will or will not interfere. Vocal behavior maintained by its effect on a parent (verbal) is susceptible to weakening by parental extinction. A parent interferes less easily with vocal behavior maintained by its direct effect (nonverbal) comparable with making noise by rubbing a stick over a rough surface. Further, such nonverbal vocal responses can emerge readily at any stage of the child's life, unlike verbal behavior, because it does not depend on a generalized reinforcement.

Failure to Develop Conditioned and Generalized Reinforcers

The normal repertoire of the child consists almost entirely of sequences of behavior that are maintained, in a chain or sequence, by conditioned and generalized reinforcers (10). An example of a chain of responses would be the behavior of the child moving a chair across the room and using it to climb to a table top to reach a key which in turn opens a cupboard containing candy. This complicated sequence of behavior is linked together by critical stimuli which have the dual function of sustaining the behavior they follow (conditioned reinforcement) and setting the occasion for the subsequent response. The chair in the above example is an occasion on which climbing onto it will bring the child into a position where reaching for food on the table top will be reinforced by obtaining food. Once this behavior is established, the chair in position in front of the table may now be a reinforcer, and any of the child's behavior which results in moving the chair into position will be reinforced because of the subsequent role of the chair in the later chain of behaviors. A minimal amount of behavior is necessary before a chain of responses can develop. The development of the control by the various stimuli in the chain, both as discriminative stimuli setting the occasion for the reinforcement of behavior and as reinforcers, depends upon a high level of activity, so that the responses will occur and come under the control of the stimuli. This is even more true for the development of the generalized reinforcer. When the child has moved enough objects about the house and achieved a variety of effects on his environment relative to a range of deprivations and reinforcers, simply manipulating the physical environment may become a reinforcer without reference to a specific level of deprivation. This, of course, is the uniquely human reinforcer that makes possible much of verbal behavior, education in general, and self-control. Again, large amounts of behavior —many chains of behavior with many different kinds of conditioned reinforcers —are a necessary condition for the emergence of a generalized reinforcer. To the extent that the child's repertoire becomes weakened by intermittent reinforcement and extinction, as mentioned above, and punishment and aversive control (see below), the possibility of the development of generalized reinforcers, and hence more complex behavior, becomes less and less likely. Parental "attention" is probably one of the most important generalized reinforcers normally maintaining the child's behavior. Parental attention is an occasion upon which the child's performances may have an important effect on the parent. Inattention is an occasion on which the child's responses are likely to have little effect. Hence, the parents' performances in smiling, saying, "Right," "Good boy," or "Thank you," all come to function as conditioned reinforcers. Their emergence as generalized reinforcers again depends upon the existence of a large behavioral repertoire. A large number of chains of responses will produce important positive effects when the parent smiles or says, "Good boy." Lower frequencies of reinforcement follow for these same activities when the parent is frowning or says, "Bad boy."

Any large reduction in the child's overall performance will interfere with the initial development of conditioned reinforcers or their continued effectiveness. The control by the environment over the child's behavior depends first upon the emission of the behavior. This follows from the manner in which the environment comes to control the child's performance: the successful execution of an act on one occasion, coupled with the unsuccessful act in its absence. Until a child climbs on chairs, as in the previous example, a chair has little chance of becoming a discriminative stimulus. Without the development of stimulus control, conditioned reinforcers cannot develop. The reinforcing effect of the chair in the above example depends upon its being the occasion on which further performances may be reinforced. In this way, a low general level of behavior may impede the enlargement of the child's repertoire because it does not allow stimulus control and in turn prevents reinforcement of new behavior. A limited development of simple conditioned reinforcers in turn prevents the development of a generalized reinforcer. Parental responses, such as smiling, "Good," or "Right," can have little effect on the child if there is not a history by which many different forms of the child's performance have produced various reinforcers on these occasions. Without parental generalized reinforcement, educational processes and positive parental control are all but impossible. This control is normally carried out by the use of praise and parental attention, coupled with mild forms of threats of discontinuing the reinforcers. Even after a generalized reinforcer has acquired its function, its continued effectiveness depends on the various stimuli continuing to stand in a significant relation to the child's performance. The actual form of the parents' generalized reinforcer is not nearly as important as the parents' subsequent reinforcement practices with the child. The reinforcing effects of the smile derive from the reinforcing practices associated with it. A smile usually functions as a generalized reinforcer in most people because a smiling person is more likely to reinforce. The correlation between smiling and reinforcement is by no means inevitable, however. Some individuals may be more disposed to punish than reinforce when smiling in some situations. In a similar vein, if the child has no behavior in his repertoire that will be more likely to be reinforced on the occasion of a parental smile, it matters little what the parent's reinforcing practices are when smiling as against when frowning.

Stimulus Control

The specific occasions on which a child's performances have their characteristic effects on the environment will subsequently determine whether the child acts. In the absence of the characteristic circumstances under which the behavior is normally reinforced, the child will be less disposed to act in proportion to the degree of similarity with the original situation. Changing a stimulus to one which has not been correlated with reinforcement is another way of weakening a repertoire. New stimuli also elicit emotional responses and general autonomic effects that may interfere with established performances. Here, simply repeated exposure to the stimuli may produce adaptation to the stimuli and eliminate their emotional effects. Ordinarily, the infants' performances are under the control of a limited range of stimuli, usually one or two parents in a limited part of a specific home environment. The discriminative repertoire broadens as the child grows older and other individuals come to be occasions on which his performances have significant effects. The parental environment of the very young child narrows the control of the child's performance to a limited range of stimuli, largely because the parent mediates almost all of the important events affecting the child. A major factor which brings the child's behavior more narrowly under the control of the parent is the nonreinforcement of much of the child's behavior in the absence of the parent. The close control of the child's behavior by the parent weakens the child's repertoire in the absence of a parent much more when there has been explicit differential reinforcement than when there has been simply a limited reinforcing environment.

Sudden shifts in the child's environment may or may not produce major performance deficits. At one extreme, a sudden shift of the stimuli in the child's controlling environment will have little influence if the child already has been reinforced on the occasion of a wide range of circumstances and individuals. At another extreme, a repertoire can be eliminated almost completely if the child has had a history in which major kinds of performances have gone unreinforced except on the occasion of a single person in a specific environment. The sudden shifts in the situations and persons controlling the child's behavior may occur under a variety of circumstances, such as a sudden change in a constant companion, death of a parent, or a sudden shift in the physical environment. A sudden shift in the environment of one of the subjects reported in the previously mentioned experiment could conceivably have been the major factor in her autistic development. Many of the activities of the child's mother were prepotent over dealing with the child, and she solved the problem by hiring a teenage baby sitter as a constant companion and nursemaid. After a year, the baby sitter left, suddenly and abruptly, leaving the child with the mother. Within four months, the child began to behave less in general, lost speech, and showed increasing frequency of atavisms. The child's repertoire possibly was under such close control of the baby sitter that the very sudden change to the mother created an environment which in the past had been correlated with nonreinforcement. If the child's behavior were under very narrow control by the baby sitter, because of the nonreinforcement on all other occasions, a sudden shift, as in the loss of the baby sitter, could produce a dramatic deficit in the child's repertoire.

Disruptive Effect of Sudden Stimulus Changes and the Amount, Durability, and Range of Behavior

A novel reinforcing environment will not sustain a child's performance unless the repertoire contains behavior of a sufficient range and durability. The new environment weakens the performance because it nearly always requires slightly different forms of behavior. For example, a new person entering a child's home is not so likely to respond successfully to the incompletely developed verbal behavior of a child as the parent. The possibility of the child's affecting the stranger will depend upon his having verbal responses different from those usually reinforced by the parent and, also, durable verbal behavior that will continue to be emitted under the intermittent reinforcement that is likely to occur. If the child's repertoire is durable and extensive enough so that the verbal response may be repeated several times and supplemented by auxiliary behavior, the child has a greater chance of affecting the new person or of being shaped by him. Similarly with other kinds of social behavior. The wider the range of behavior and the greater the disposition to emit it the more likely that the child's performance will be within the range of responses potentially reinforcible by the new environment.

For a stimulus to acquire control over behavior, the child must first emit behavior in the presence of the stimulus. Consider, for example, the performance of a child at a children's party at which there are lots of toys and games, such as bicycles, swings, and so forth. The likelihood of the child's behavior coming under the control of any of the other children as reinforcers is minimal if the new environment suppresses or makes the child's entire repertoire unavailable because it is a novel stimulus and is an occasion on which the child's behavior has never been reinforced. If the behavior of playing with a swing or riding a tricycle is sufficiently strong that it may be emitted even under the adverse conditions of the very strange party environment, then the simple emission of the previously developed behavior provides a situation under which other children at the party may potentially reinforce or otherwise affect the child's repertoire. Simply the acts of eating cake, candy, or ice cream, or picking up a toy put some of the child's behavior under the control of the new environment. Each new performance which can potentially occur at the party provides a basis for the child's reinforcing some behavior of other children at the party or of his coming under the control of the other children's reinforcers. On the other hand, a sudden exposure to a new environment with a weak and narrow repertoire may produce a severe behavioral deficit. In any case, the child will be much less disposed to go to the party if he had behaved unsuccessfully in the new environment. This lower disposition to attend and engage in the party would in turn make it less likely that the child will emit behavior that would be reinforced in the party environment.

ADAPTATION

The emotional and elicited autonomic effects of novel environments may also interfere with a child's performances. Adaptation to new environments occurs with gradual exposure. A sudden exposure to a new environment will produce gross emotional and autonomic responses which will in turn interfere with, or even completely suppress, the emission of possible operant behavior potentially reinforcible by the new environment. The rate at which the child is exposed to the new environments will determine the magnitude of disturbance. Exposure to a new environment and adaptation of the emotional responses do not necessarily create the potential basis for responding, however. A repertoire that will make contact with the new environment is also necessary.

AMOUNT OF PRIOR NONREINFORCEMENT

The more closely controlled the child's performances are by specific stimuli, the more likely a sudden shift in the environment will produce a cessation of responding. For example, the child receiving minimal care from a parent probably will be less affected by a sudden shift in environment than a child closely affected and controlled by parental response. It is paradoxical that the parent who responds sensitively to the child's performance may be potentially weakening it more than the parent who exerts little control over the child. It is the alternate reinforcement and nonreinforcement that place the child's behavior narrowly under the control of very specific stimuli so that it is much more vulnerable to sudden changes. The range of stimuli in whose presence the child's behavior goes unreinforced will determine the narrowness of the stimulus control.

Cumulative Effects of a Behavioral Deficit

The continuous development of more and more complex forms of a child's behavior is normally achieved because the parents and community approximate the required performances. At each stage of the child's development, the community reinforces the child's current repertoire even though it is more disposed to react to small increments in the child's performance in the direction of the required complex performances. Should any of the above processes produce a deficit in performance or an arrest in the development of the child's performance, further development of a repertoire would depend upon the community's relaxing its requirements and reinforcing performances in an older child that it normally accepts only from a younger one. Ordinarily, the reinforcing practices of the community are based on the chronological age and physical development of the child.

Only between the ages of 1½ to 4 years does the parent have sufficient control of the child to weaken his performance to the degree seen in infantile autism. This is a critical period in the child's development during which his behavior is especially susceptible to extinction, because the traditional social pattern in the usual family restricts the child's experience to one or two parents. Before the age of 1½, the child has few performances with which the parent will interfere or that have important effects on the parent. Much of the infant's behavior is maintained by simple and direct effects on its environment. As the child approaches 2 years, the rapid development of a behavioral repertoire, particularly social and verbal behavior, makes possible extinction and other forms of weakening. The effectiveness of the parental environment in weakening the child's repertoire depends upon the availability of concurrent audiences for the child's behavior. In general, the 2-year-old child is limited to the home and comes into increasing contact with other environments as he grows older, perhaps reaching a maximum at school age. The presence of an older sibling might appear to preempt the possibility of a sufficient degree of isolation to account for an aversive behavioral deficit. A sibling could provide an alternative to the parent as a reinforcing environment. The behavioral or functional influence of a sibling would depend on the amount and nature of interaction between the children. For example, an older child might possibly completely avoid the younger one or tend to have the same patterns of reaction as the parent. In many cases, the older sibling has playmates outside the home to the complete exclusion of the younger child. The older sibling, in many circumstances, punishes as well as extinguishes the younger child for any attempted participation in his play. There are very few facts as to the exact nature of the interactions in most cases.

The parent as the sole maintainer of the child's behavior is perhaps even more likely when the child is raised in a rural or isolated community, and perhaps with one of the parents largely absent. The above analysis suggests that a survey of severely autistic children would, in general, show them to be first-born children; or, if other siblings were available, they would have provided little interaction with the child. It also suggests that the child would be raised in a house physically or socially isolated from other families or children such that there were no alternative social environments that could provide reinforcement for the child's behavior. When the child was exposed to both parents, it would be expected that both parents were consistent in their nonreinforcement of the child's performances.

Aversive Control and Punishment

It has been possible to describe conditions which might produce major behavioral deficits without dealing with punishment or aversive control. A similar account might present a functional analysis of how performance deficits might occur as a result of aversive control. Many writers have already described some of these factors by extending general principles of aversive control to human behavior (7, 8, 11). For the purposes of the analysis presented in this paper, I should like to restrict the discussion of aversive control to its relation to positive reinforcement. Much of human aversive control is carried out by discontinuing or withdrawing reinforcement (3, 10). For example, a frown or criticism may function as an aversive stimulus because these are occasions on which reinforcements are less likely to occur. Even when corporal punishment is given, it is not clear as to whether the resulting effect on the child's behavior is due to a slap or to the lower inclination of a punishing parent to reinforce. Most parents who spank a child will be indisposed to act favorably toward the child for some period of time subsequently. As a result, one major by-product of frequent punishment may be a larger order of interference with the child's normal repertoire along the lines of the positive reinforcement deficits described above.

The obvious effectiveness of punishment in some kinds of human control appears to contradict experimental findings with animals which show punishment to have only a temporary effect on behavior (1, 2, 9). The role of positive reinforcement factors helps resolve the dilemma. The effectiveness of punishment depends on how strongly the punished behavior is maintained by positive reinforcement. The apparent effectiveness of punishment in the control of children may occur when weak repertoires are punished or when the punishment indirectly produces extinction. Most animal experiments using electric shock as an aversive stimulus have used strongly maintained positively reinforced operant behavior as the base-line performance to be punished. The aversive control might be more effective when the performances to be punished are less strongly maintained.

Conclusion

As might be expected from the relatively low frequency of infantile autism, the combination of circumstances hypothesized above would occur only rarely. The above hypothesis provides a framework for investigating the circumstances surrounding the development of the autistic child. All of the variables that might weaken the behavior of a child are directly or potentially observable. The data required are the actual parental and child performances and their specific effects on each other, rather than global statements such as dependency, hostility, or socialization. Not all of the factors responsible for a child's performance may be present currently. Using retrospective accounts, however, makes it difficult to determine the actual correspondence between the verbal statements of the parent and their actual practices in raising the child. The alternatives are, first, an objective assessment of the child's repertoire in a wide enough range of environments so as to allow an assessment of the nature of the environmental control of the child's current behavior; and, second, actual home observations of the specific social consequences of the child's performances early in the development of the disease.

The same kind of functional analysis can be made for the performance of the adult psychotic although the specific deficits observed in autistic children and their manner of occurrence may not be relevant. In particular, the analysis of the adult's behavior would be more concerned with the factors which weaken behavior already in the repertoire rather than the development of new repertoires as with the analysis of the autistic child's behavior. Maintaining already-established behavior is more at issue in the adult than the initial development of a performance as in the case of the child (3).

REFERENCES

1. Azrin, N. H. Punishment and recovery during fixed-ratio performance. *J. exp. anal. Behav.*, 1959, **2,** 301–305.
2. Estes, W. K. An experimental study of punishment. *Psychol. Monogr.*, 1944, **57,** No. 3 (Whole No. 623).
3. Ferster, C. B. Reinforcement and punishment in the control of human behavior by social agencies. *Psychiat. Res. Repts. 10*, 1958, **12,** 101–118.
4. Ferster, C. B., & DeMyer, M. K. A method for the experimental analysis of the behavior of autistic children. *Amer. J. Orthopsychiat.*, in press.
5. Ferster, C. B., & DeMyer, M. K. The development of performances in autistic children in an automatically controlled environment. *J. chronic Dis.*, 1961, **13,** 312–345.
6. Kanner, L. Early infantile autism. *J. Pediat.*, 1944, **25,** 211–217.
7. Miller, N. E., & Dollard, S. *Personality and psychotherapy*. McGraw-Hill, 1950.
8. Rotter, Julian. *Social learning and clinical psychology*. Prentice-Hall, 1954.
9. Skinner, B. F. *The behavior of organisms*. Appleton-Century-Crofts, 1938.
10. Skinner, B. F. *Science and human behavior*. Macmillan, 1953.
11. Skinner, B. F. Some contributions of an experimental analysis of behavior to psychology as a whole. *Amer. Psychologist*, 1953, **8,** 69–78.
12. Skinner, B. F. *Verbal behavior*. Appleton-Century-Crofts, 1957.

chapter IX

Behavioral Treatment

Again, in the area of behavioral modification for clinical purposes, the two learning approaches stemming from Hull and Skinner have been productive. The application of a Hullian learning approach to problems of abnormal behavior commenced first within the framework of traditional psychotherapy (for example, Dollard and Miller, 1950). More recently (Wolpe, 1958; Eysenck, 1960) new methods of treatment involving direct respondent conditioning have been evolved within this approach. On the other hand, at the present time in the United States, the strongest impetus in the application of learning principles to clinical problems has stemmed from an operant conditioning framework.

This section will be concerned with sampling some of the studies in which learning principles have been applied to behavioral modification in applied settings in a manner which has implications for treatment procedures. The first article by Aylion and Michael is a very convincing demonstration of the relevance of operant conditioning principles and methods. In this study various problem behaviors of hospitalized psychotic patients are "cured" through the manipulation of reinforcement variables. In this series of treatments for various patients, such principles as extinction, satiation, negative reinforcement, and positive reinforcement are utilized. The results indicated that the bizarre behaviors of the psychotic functioned according to the usual principles of learning, contrary to the conception of many people. Furthermore, the study supports the suggestion made in the last chapter *that many of these unusual and inappropriate behaviors are being shaped up and maintained within the hospital situation by the conditions of learning which apply in these settings.*

As discussed fully as a general problem in Selection 13, when one is interested in training programs involving complex human behaviors—which means long-term training—one important problem is that of an adequate reinforcing system. It is noteworthy that the basic training which the child receives occurs when the trainers, the parents, have a very powerful and durable system of reinforcers. In the typical mental hospital, however, the patients receive all the primary reinforcers which are requisite—not contingent upon any type of behavior. This being the case, unless the patient has a strongly developed system of conditioned social reinforcers, it would be expected there would be little means with which to maintain strong (motivated) learning behaviors. Ayllon and Haughton show how food may be used as a strong reinforcer in the neuropsychiatric setting, first to maintain eating behavior to more and more exacting demands. Then, among other things, the situation was changed so that various simple social behaviors were requisite. In these demonstrations the required behavior was actually reinforced by a token which enabled the patient to gain access to the dining hall.

The success of these training procedures has far reaching implications. It suggests that through use of an extensive token system, such as described in different contexts in previous chapters (for example, Staats, 1963, in Chapter III), it should be possible to construct training programs dealing with behaviors significant to adjustment for the treatment of psychotic patients. For many of these patients the use of more usual conditioned social reinforcers would be ineffective. This study of Ayllon and Haughton also strongly supports the learning interpretation of abnormal behavior.

The next article by Isaacs, Thomas, and Goldiamond is an account of how an important deficit in behavior may be rectified through the use of operant methods. Through successive approximation training techniques the speech behavior of two mute schizophrenics is reinstated. This corroborates the implications of the preceding study—that adjustive behaviors can be operantly conditioned in long standing psychoses through manipulating available reinforcers. An important elaboration of the implication is given by the fact that in the present study a significant complex human behavior of great adjustive value is involved. In the present case the reinforcers used were actually inexpensive and probably not very strong. This suggests that much more could be done where a more potent reinforcer system was used.

Finally, it seems that the learning potentialities for both adjustive and maladjustive behaviors of even very deteriorated back-wards patients of many years standing has been sharply underrated. Much of the poor behavioral repertoires which exist in such patients may be seen as the result of impoverished conditions within the hospital itself for the acquisition and maintenance of adjustive behavior. It might be added that, important as these studies are, they represent only a bare beginning in the potential development of reinforcer systems as well as in the application of these systems to the treatment of complex human behavior problems.

The next article shows how disruptive behavior in a child may be treated through manipulating reinforcement conditions. In this case the parent's handling of the child had resulted in full-blown temper tantrums. Treatment consisted of withdrawing reinforcement for that behavior.

The next article by Bandura summarizes some of the behavior principles which can be considered to be part of psychotherapy, some of the progress which has been made in the establishment of a general rationale for behavioral treatment within a learning framework, as well as some of the progress which must be made in establishing an integrated learning approach.

Another indication of the way in which a behavioristic psychotherapy should be moving is indicated by the article by Ferster, Nurnberger, and Levitt. This article gives a more detailed analysis of one type of inappropriate behavior (overeating). The analysis involves many behavior principles and suggests an extensive treatment program. The behavior, its controlling stimuli, the effective reinforcers, and so on, are analyzed, and the possibilities for the manipulation of these variables in treatment are set forth. It is suggested that this type of analysis may be the prototype for the development of adequate *learning programs* for the treatment of various behavioral disorders. A complete analysis for each of the many behavior problems, supported by research, will eventually be necessary in the development of a behavioristic psychotherapy which will eventually have to include well-worked-out learning programs for each of the many problems of behavior.

44.

The Psychiatric Nurse as a Behavioral Engineer*[1]

Teodoro Ayllon[2] *and Jack Michael*

The behavior which leads to a person's admission to a mental hospital often involves danger to himself or others, withdrawal from normal social functions, or a dramatic change from his usual mode of behaving. The professional staff of the psychiatric hospital directs its major efforts toward the discovery of the flaw in the patient's mental apparatus which presumably underlies his disturbing and dangerous behavior. Following the medical paradigm, it is presumed that once the basic disfunction has been properly identified the appropriate treatment will be undertaken and the various manifestations of the disfunction will disappear.

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* From T. Ayllon and J. Michael, The psychiatric nurse as a behavioral engineer, *J. exp. anal. Behav.*, **2,** 323–334 (1959). Reprinted by permission of the authors and the *Journal of the Experimental Analysis of Behavior.*

[1] This paper contains a portion of the data from a doctoral dissertation submitted to the Department of Psychology, University of Houston, in partial fulfillment of the requirements for the Ph.D. degree, in August, 1959. Grateful acknowledgment is due to the members of the doctoral committee for their help and encouragement, and also to Drs. H. Osmond and I. Clancey, Superintendent and Clinical Director of the Saskatchewan Hospital, for making research at this institution possible.

[2] Now at Saskatchewan Hospital, Weyburn, Saskatchewan.

While diagnosis is being made and during subsequent treatment, the patient is under the daily care of the psychiatric nurses[3] in the ward. There, he often exhibits annoying and disrupting behavior which is usually regarded as a further manifestation of his basic difficulty. This behavior is sometimes identical with that which led to his admission; but at other times it seems to originate and develop within the hospital setting. Although it is still regarded as a reflection of his basic problem, this disruptive behavior may become so persistent that it engages the full energies of the nurses, and postpones, sometimes permanently, any effort on their part to deal with the so-called basic problem.

Disrupting behaviors usually consist in the patient's failure to engage in activities which are considered normal and necessary; or his persistent engagement in activities that are harmful to himself or other patients, or disrupting in other ways. For example, failures to eat, dress, bathe, interact socially with other patients, and walk without being led are invariably disruptive. Hoarding various objects, hitting, pinching, spitting on other patients, constant attention-seeking actions with respect to the nurses, upsetting chairs in the dayroom, scraping paint from the walls, breaking windows, stuffing paper in the mouth and ears, walking on haunches or while in a squatting position are disruptive when they occur frequently and persistently.

At present, no systematic approach to such problems is available to the nurses. A psychodynamic interpretation is often given by psychiatrists and psychologists; and, for that matter, the nurses sometimes construct "depth" interpretations themselves. These interpretations seldom suggest any specific remedial actions to the nurses, who then have no other recourse than to act on the basis of common sense, or to take advantage of the physical therapy in vogue. From the point of view of modern behavior theory, such strong behaviors, or behavioral deficits, may be considered the result of events occurring in the patient's immediate or historical environment rather than the manifestations of his mental disorder. The present research represents an attempt to discover and manipulate some of these environmental variables for the purpose of modifying the problem behavior.

Research Setting

The research was carried out at the Saskatchewan Hospital, Weyburn, Saskatchewan, Canada. It is a psychiatric hospital with approximately 1500 patients. Its most relevant features in terms of the present experiment are:

1. The nurses are trained as psychiatric nurses in a 3-year program.

2. They are responsible for the patients in their wards and enjoy a high degree of autonomy with respect to the treatment of a patient. The psychiatrists in the hospital function as advisers to the nursing

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[3] As used in this paper, "psychiatric nurse" is a generic term including all those who actually work on the ward (aides, psychiatric nurses, and registered nurses).

staff. This means that psychiatrists do not give orders, but simply offer advice upon request from the psychiatric nurses.

3. The nurses administer incoming and outgoing mail for the patients, visitor traffic, ground passes, paroles, and even discharge, although the last is often carried out after consultation with a psychiatrist. The nurses also conduct group therapy under the supervision of the psychiatric staff.

The official position of the senior author, hereafter referred to as *E*, was that of a clinical psychologist, who designed and supervised operant-conditioning "therapy" as applied by the nurses. Once his advice had been accepted, the nurses were responsible for carrying out the procedures specified by *E*. It was the privilege of the nurses to discontinue any treatment when they believed it was no longer necessary, when they were unable to implement it because of lack of staff, or when other ward difficulties made the treatment impossible. Whenever termination became necessary, *E* was given appropriate notice.

Subjects

The subjects used in this investigation were all patients in the hospital. Of the total 19 patients, 14 had been classified as schizophrenic and 5 as mentally defective. Except for one female patient who was resident for only 7 months, all patients had been hospitalized for several years. Each subject presented a persistent behavior problem for which he had been referred to *E* by the nursing staff. None of the Ss was presently receiving psychotherapy, electroconvulsive therapy, or any kind of individual treatment.

The behaviors which were studied do not represent the most serious problems encountered in a typical psychiatric hospital. They were selected mainly because their persistence allowed them to survive several attempts at altering them.

Procedure

Prior to a systematic observational study of the patient's behavior the nurses were asked about the kind and frequency of naturally occurring reinforcement obtained by the patient, the duration and frequency of the problem behavior, and the possibility of controlling the reinforcement. Next, a period of systematic observation of each patient was undertaken prior to treatment. This was done to obtain objective information on the frequency of the behavior that was a problem to the nurses, and to determine what other behaviors were emitted by the patient.

Depending on the type of behavior, two methods were used for recording it. If the behavior involved interaction with a nurse, it was recorded every time it occurred. Entering the nurses' office, and eating regular meals are examples of such behavior.

Behavior which did not naturally involve contact with the nurse was recorded by a time-sampling technique. The nurse who was in charge of the program was supplied with a mimeographed record form. She sought out the patient at regular intervals; and without interaction with him, she recorded the behavior taking place at that time. She did not actually describe the behavior occurring, but rather classified it in terms of a pre-established trichotomy: (a) the undesirable behavior; (b) incompatible behavior which could ultimately displace the undesirable behavior; and (c) incompatible behavior which was not considered shapeable, such as sleeping, eating, and dressing. (Although these latter acts are certainly susceptible to the influence of reinforcement, they were regarded as neutral behaviors in the present research.) The period of observation varied from 1 to 3 minutes. After making an observation, the nurse resumed her regular ward activities until the next interval was reached, whereupon she again sought out the patient. Except for one patient, who was observed every 15 minutes, such observations were made every 30 minutes.

The relevant aspect of the data obtained by the time-check recording is the proportion of the total number of observations (excluding observations of neutral behavior) during which the patient was engaging in the behavior being altered. This will be called the relative frequency of the behavior. As an example, on the first day of the program of extinction for psychotic talk in the case of Helen (see below), 17 nonneutral behaviors were recorded. Of these, nine were classed as psychotic talk and eight as sensible talk; the relative frequency of psychotic talk was 0.53.

Although it would have been desirable, a long pretreatment period of observation was precluded by the newness of this approach and the necessity of obtaining the voluntary cooperation of the nurses.

After the pretreatment study had been completed, *E* instructed the ward nurses in the specific program that was to be carried out. In all cases the instruction was given at ward meetings and usually involved the cooperation of only two shifts, the 7 a.m. to 3 p.m., and 3 p.m. to 11 p.m., since the patients were usually asleep during the 11 p.m. to 7 am. shift.

The pretreatment studies indicated that what maintained undesirable behavior in most of the patients was the attention or social approval of the nurses toward that behavior. Therefore, the emphasis in instructing the nursing staff was on the operation of giving or withholding social reinforcement contingent upon a desired class of behavior. What follows illustrates the tenor of *E*'s somewhat informal instructions to the nurses. "Reinforcement is something you do for or with a patient, for example, offering candy or a cigarette. Any way you convey attention to the patient is reinforcing. Patients may be reinforced if you answer their questions, talk to them, or let them know by your reaction that you are aware of their presence. The common-sense expression 'pay no attention' is perhaps closest to what must be done to discourage the patient's behavior. When we say 'do not reinforce a behavior,' we are actually saying 'ignore the behavior and act deaf and blind whenever it occurs.' "

When reinforcement was given on a fixed-interval basis, the nurse was instructed to observe the patient for about 1 to 3 minutes at regular intervals, just as in the pretreatment observation period. If desirable behavior was occurring at the time of observation, she would reinforce it; if not, she would go on about her duties and check again after the next interval had passed. Strictly speaking, this is fixed interval with a limited-hold contingency (Ferster & Skinner, 1957). During a program of extinction the nurse checked as above; however, instead of reinforcing the patient when he exhibited the behavior being altered, she simply recorded it and continued her other work. Except for specific directions for two patients, the nurses were not given instructions on the operation of aversive control.

The programs requiring time-sample observations started after breakfast (around 9 a.m.) and ended at bedtime (around 9 p.m.), and were usually carried out by only one of the 6 to 12 nurses on each shift. Because of the daily shift changes, the monthly ward rotations, and a systematic effort to give everyone experience at this new duty, no patient's program was followed by any one nurse for any considerable length of time. Nineteen, as a minimum, different nurses were involved in carrying out each patient's program. Over 100 different nurses participated in the entire research project.

Most social ward activities took place in the dayroom, which was a large living room containing a television set, card tables, magazines, and games. It was here that reinforcement was given for social behaviors toward patients, and for nonsocial behaviors which were strengthened to compete with undesirable behaviors. The fact that the research was carried out in five wards distributed far from each other in a four-floor building made it impossible for *E* to observe all the nurses involved in the research at any one time. Because of the constant change in nursing personnel, most of *E*'s time was spent in instructing new people in the routines of the programs. In addition, since *E* did not train the nurses extensively, he observed them, often without their knowledge, and supervised them in record keeping, administering reinforcement, extinction, etc. That the nurses performed effectively when *E* was absent can be at least partially determined by the ultimate results.

Results

The results will be summarized in terms of the type of behavior problem and the operations used in altering the behavior. In general, the time required to change a specific behavior ranged from 6 to 11 weeks. The operations were in force for 24 hours a day, 7 days a week.

Strong Behavior Treated by Extinction, or Extinction Combined with Reinforcement for Incompatible Behavior

In the five cases treated with this program, the reinforcer was the attention of the nurses; and the withholding of this reinforcer resulted in the expected decline in frequency. The changes occurring in three of the behavior problems, scrubbing the floor, spending too much time in the bathroom, and one of the two cases of entering the nurses' offices, were not complicated by uncontrollable variables. Lucille's case is presented in detail as representative of these three. The interpretation of the changes occurring in the other two behavior problems, entering the nurses' offices, and psychotic verbal behavior, is not so clearcut. Helen's case illustrates this point. For details concerning the cases not discussed in this paper, see Ayllon (1959).

Lucille

Lucille's frequent visits to the nurses' office interrupted and interfered with their work. She had been doing this for 2 years. During this time, she had been told that she was not expected to spend her time in the nurses' office. Frequently, she was taken by the hand or pushed back bodily into the ward. Because the patient was classified as mentally defective, the nurses had resigned themselves to tolerating her behavior. As one of the nurses put it, "It's difficult to tell her anything because she can't understand—she's too dumb."

The following instructions were given to the nurses: "During this program the patient must not be given reinforcement (attention) for entering the nurses' office.

Tally every time she enters the office."

The pretreatment study indicated that she entered the office on an average of 16 times a day. As Fig. 1b shows, the average frequency was down to two entries per day by the seventh week of extinction, and the program was terminated. Figure 1a shows the same data plotted cumulatively.

Helen

This patient's psychotic talk had persisted for at least 3 years. It had become so annoying during the last 4 months prior to treatment that other patients had on several occasions beaten her in an effort to keep her quiet. She was described by one of the psychiatrists as a "delusional" patient who "feels she must push her troubles onto somebody else, and by doing this she feels she is free." Her conversation centered around her illegitimate child and the men she claimed were constantly pursuing her. It was the nurses' impression that the patient had "nothing else to talk about."

A 5-day pretreatment observation of the patient was made at 30-minute intervals to compare the relative frequencies of psychotic and sensible content in her talk. Some of the nurses reported that, previously, when the patient started her psychotic talk, they listened to her in an effort to get at the "roots of her problem." A few nurses stated that they did not listen to what she was saying but simply nodded and remarked, "Yes, I understand," or some such comment, the purpose of which was to steer the patient's conversation onto some other topic. These reports suggested that the psychotic talk was being maintained by the nurses' reaction to it. While it is recognized that a distinction between psychotic and normal talk is somewhat arbitrary, this case was included in the research because of its value as a problem involving primarily verbal behavior.

The following instructions were given to the nurses: "During this program the

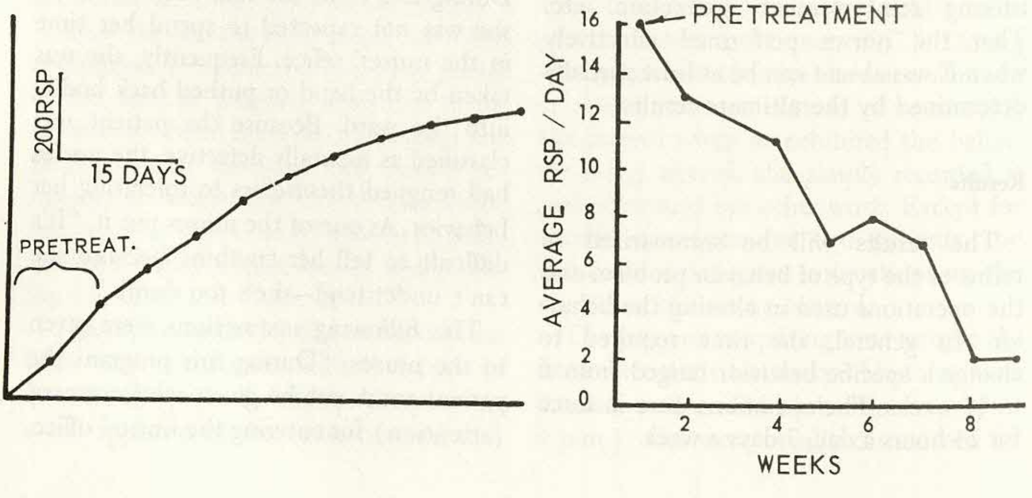


FIG. 1. Extinction of the response "entering the nurses' office"; a. cumulative record, b. conventional record. From Aylion and Michael: The psychiatric nurse as a behavioral engineer.

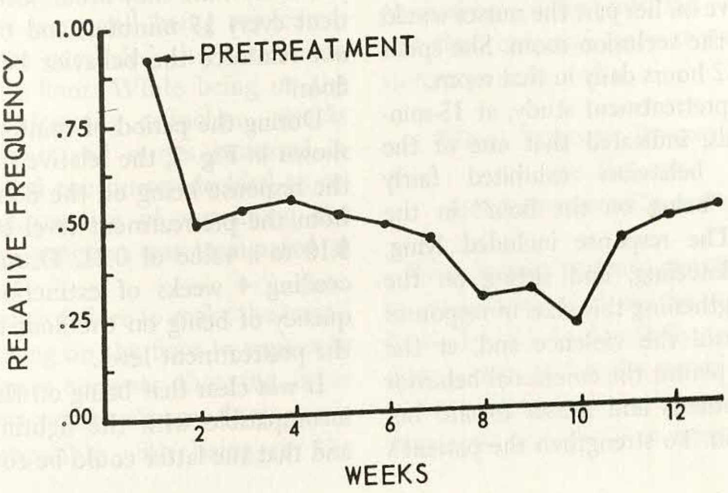
patient must not be given reinforcement (attention) for her psychotic talk (about her illegitimate child and the men chasing her). Check the patient every 30 minutes, and (a) tally for psychotic talk; and (b) reinforce (and tally) sensible talk. If another patient fights with her, avoid making an issue of it. Simply stop the other patient from hurting her, but do so with a matter-of-fact attitude."

The 5-day observation period resulted in a relative frequency of psychotic talk of 0.91. During treatment (Fig. 2), the relative frequency dropped to less than 0.25; but, later on, it rose to a value exceeded only by the pretreatment level. The sudden increase in the patient's psychotic talk in the ninth week probably occurred because the patient had been talking to a social worker, who, unknown to the nurses, had been reinforcing her psychotic talk. The reinforcement obtained from the social worker appeared to generalize to her interaction with other patients and nurses. The patient herself told one of the nurses, "Well, you're not listening to me. I'll have to go and see Miss __________ (the social worker) again, 'cause she told me that if she would listen to my past she could help me."

In addition to the reinforcement attributable to the social worker, two other instances of bootleg reinforcement came to light. One instance occurred when a hospital employee came to visit the ward, and, another, when volunteer ladies came to entertain the patients. These occasions were impossible to control, and indicate some of the difficulties of long-term control over verbal behavior.

It is of interest to note that since the reinforcement program began, the patient has not been attacked by the other patients and is only rarely abused verbally. These improvements were commented upon by the nurses, who were nevertheless somewhat disappointed. On the basis of the improvement shown in verbal behavior, the nurses had expected a dramatic over-all change which did not occur.

FIG. 2. Extinction of psychotic talk. From Ayllon and Michael: The psychiatric nurse as a behavioral engineer.



STRONG BEHAVIOR TREATED BY STRENGTHENING INCOMPATIBLE BEHAVIOR

This case represented an attempt to control violent behavior by strengthening an incompatible class of responses, and to recondition normal social approaches while the violence was under control. The first phase was quite successful; but errors in strategy plagued the last half of the program, and it was terminated by the nurses because the patient became more violent.

The immediate reason for referral was that the patient, Dotty, had become increasingly violent over the last 5 years, and recently attacked several patients and hospital personnel without any apparent reason. Since admission and up to the present, she had received many electroconvulsive-therapy treatments aimed at reducing this violence, with little or no success. In 1947, a physician recommended her as a good case for psychosurgery. In December of the same year, she attempted to strangle her mother who was visiting her at the time. In July 1948, the patient had a leucotomy. The situation had recently become so serious that at the least suspicious move on her part the nurses would put her in the seclusion room. She spent from 3 to 12 hours daily in that room.

A 5-day pretreatment study, at 15-minute intervals, indicated that one of the nonviolent behaviors exhibited fairly often was "being on the floor" in the dayroom. The response included lying, squatting, kneeling, and sitting on the floor. Strengthening this class of responses would control the violence and, at the same time, permit the emotional behavior of other patients and nurses toward her to extinguish. To strengthen the patient's own social behavior, her approaches to the nurses were to be reinforced. The response "approach to nurse" was defined as spontaneous requests, questions or comments made by the patient to the nurse. Ultimately, the plan was to discontinue reinforcing being on the floor once the patient-nurse social interaction appeared somewhat normal. Presumably, this would have further increased the probability of approach to the nurses.

For the duration of the program, continuous social reinforcement was to be available for her approach to the nurses. Social reinforcement was to be available for the first 4 weeks only, on a fixed interval of 15 minutes, contingent on the response being on the floor. For the last 4 weeks, social reinforcement was to be withheld for being on the floor.

The following instructions were given to the nurses for the first 4 weeks of the program: "Reinforce (and tally) her approaches to you every time they occur. Check the patient every 15 minutes, and reinforce (and tally) the behavior being on the floor."

From the fifth week on the instructions were modified as follows: "Continue reinforcing (and tallying) her approaches to you every time they occur. Check the patient every 15 minutes, and tally but do not reinforce the behavior being on the floor."

During the period of reinforcement, as shown in Fig. 3, the relative frequency of the response being on the floor increased from the pretreatment level of less than 0.10 to a value of 0.21. During the succeeding 4 weeks of extinction, the frequency of being on the floor returned to the pretreatment level.

It was clear that being on the floor was incompatible with the fighting behavior and that the latter could be controlled by

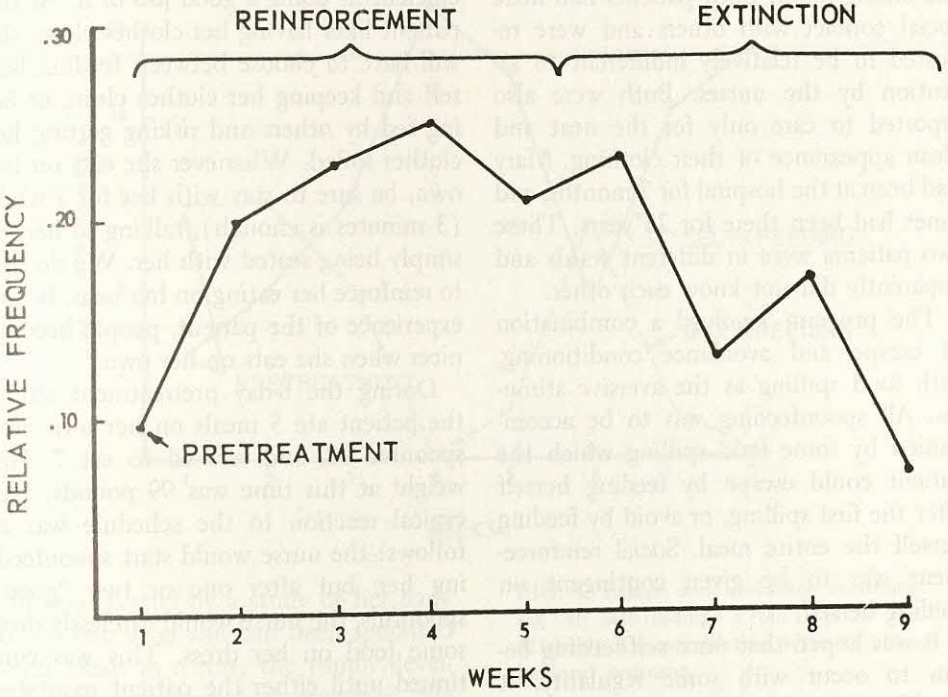


FIG. 3. Reinforcement and subsequent extinction of the response "being on the floor." From Ayllon and Michael: The psychiatric nurse as a behavioral engineer.

reinforcing the former. During the period of reinforcement for being on the floor, she attacked a patient once; but during the period of extinction, she made eight attacks on others. Her approaches to nurses increased over-all during the 4 weeks of reinforcement, but they decreased during the last 4 weeks, even though they were still being reinforced. This decrease paralleled the decrease in being on the floor. While being on the floor was undergoing extinction, attacks on the patients and nurses increased in frequency, and the nurses decided to return to the practice of restraining the patient. The program was terminated at this point.

The patient's failure to make the transition from being on the floor to approaching the nurses suggests that the latter response was poorly chosen. It was relatively incompatible with being on the floor. This meant that a previously reinforced response would have to be extinguished before the transition was possible, and this, too, was poor strategy with a violent patient.

Weak Behavior Strengthened by Escape and Avoidance Conditioning

Two female patients generally refused to eat unless aided by the nurses. One, Janet, had to be forcefully taken to the dining room, where she would permit the nurses to spoonfeed her. The other patient, Mary, was spoonfed in a room adjacent to the dining room. Both patients had little social contact with others and were reported to be relatively indifferent to attention by the nurses. Both were also reported to care only for the neat and clean appearance of their clothing. Mary had been at the hospital for 7 months, and Janet had been there for 28 years. These two patients were in different wards and apparently did not know each other.

The program involved a combination of escape and avoidance conditioning, with food spilling as the aversive stimulus. All spoonfeeding was to be accompanied by some food spilling which the patient could escape by feeding herself after the first spilling, or avoid by feeding herself the entire meal. Social reinforcement was to be given contingent on feeding herself.

It was hoped that once self-feeding began to occur with some regularity, it would come under the control of environmental variables which maintain this behavior in most people, such as convenience, social stimulation at meal time, etc. In both cases, the program ultimately resulted in complete self-feeding, which now has been maintained for over 10 months. Janet's behavior change was complicated by a history of religious fasting, and her change took a little longer. Mary's case will be given here in detail.

The following instructions were given to the nurses: "Continue spoonfeeding the patient; but from now on, do it in such a careless way that the patient will have a few drops of food fall on her dress. Be sure not to overdo the food dropping, since what we want to convey to the patient is that it is difficult to spoonfeed a grown-up person, and not that we are mean to her. What we expect is that the patient will find it difficult to depend on your skill to feed her. You will still be feeding her, but you will simply be less efficient in doing a good job of it. As the patient likes having her clothes clean, she will have to choose between feeding herself and keeping her clothes clean, or being fed by others and risking getting her clothes soiled. Whenever she eats on her own, be sure to stay with her for a while (3 minutes is enough), talking to her, or simply being seated with her. We do this to reinforce her eating on her own. In the experience of the patient, people become nicer when she eats on her own."

During the 8-day pretreatment study, the patient ate 5 meals on her own, was spoonfed 12, and refused to eat 7. Her weight at this time was 99 pounds. Her typical reaction to the schedule was as follows: the nurse would start spoonfeeding her; but after one or two "good" spoonfuls, the nurse would carelessly drop some food on her dress. This was continued until either the patient requested the spoon, or the nurse continued spoonfeeding her the entire meal. The behaviors the patient adopted included (a) reaching for the spoon after a few drops had fallen on her dress; (b) eating completely on her own; (c) closing her mouth so that spoonfeeding was terminated; or (d) being spoonfed the entire meal. Upon starting the schedule, the most frequent of all these alternatives was the first; but after a while, the patient ate on her own immediately. The relevant data are shown in Fig. 4. On the 12th day, the patient ate all three meals on her own for the first time. Four meals were refused out of the last 24: one meal was missed because she stated she didn't like "liver" and the other three because she said she was not hungry. Her weight when she left the hospital was 120 pounds, a gain of 21 pounds over her pretreatment weight.

Mary's relapse in the fifth week, after she had been eating well for 2 weeks, was quite unexpected. No reasonable explan-

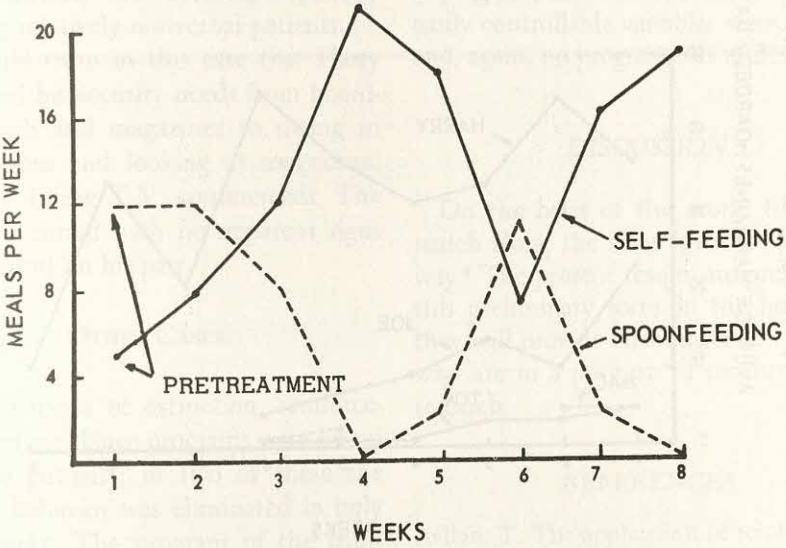


FIG. 4. Escape and avoidance conditioning of self-feeding. From Aylion and Michael: The psychiatric nurse as a behavioral engineer.

ation is suggested by a study of her daily records; but, after she had been spoonfed several meals in a row, the rumor developed that someone had informed the patient that the food spilling was not accidental. In any event, the failure to feed herself lasted only about 5 days.

Since the patient's hospital admission had been based on her refusal to eat, accompanied by statements that the food was poisoned, the success of the program led to her discharge. It is to be noted that although nothing was done to deal directly with her claims that the food was poisoned, these statements dropped out of her repertoire as she began to eat on her own.

STRONG BEHAVIOR WEAKENED THROUGH A COMBINATION OF EXTINCTION FOR SOCIAL ATTENTION AND STIMULUS SATIATION

For 5 years, several mentally defective patients in the same ward, Harry, Joe, Tom, and Mac, had collected papers, rubbish, and magazines and carried these around with them inside their clothing next to their body. The most serious offender was Harry, whose hoarding resulted in skin rashes. He carried so much trash and so persistently that for the last 5 years the nurses routinely "dejunked" him several times during the day and before he went to bed.

An analysis of the situation indicated that the patient's hoarding behavior was probably maintained by the attention he derived because of it and by the actual scarcity of printed matter. There were few papers or magazines in the ward. Some were brought in occasionally; but since they were often torn up and quickly disappeared, the nurses did not bring them in very often.

It was expected that flooding the ward with magazines would decrease the hoarding behavior after the paradigm of satiation. Similarly, the availability of many magazines was expected to result in their being the major object of hoarding. The

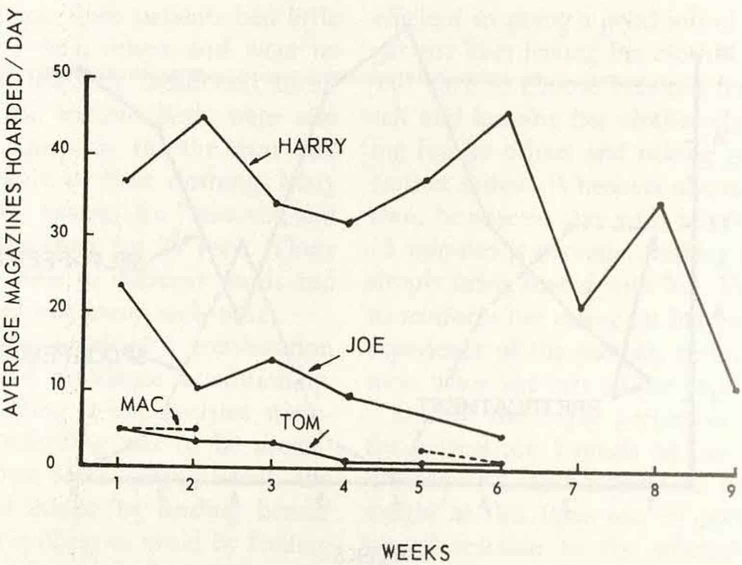


FIG. 5. Satiation and extinction of two forms of magazine hoarding. From Ayllon and Michael: The psychiatric nurse as a behavioral engineer.

latter would facilitate an easier measurement of this behavior.

In addition, social reinforcement was to be withheld for hoarding magazines and rubbish. The results for all patients were essentially similar: a gradual decrease in hoarding. After 9 weeks of satiation and extinction, the program was terminated, since hoarding was no longer a problem. This improvement has been maintained for the last 6 months.

The following instructions were given to the nurses: "During this program the patients Harry, Mac, Joe, and Tom must not be given reinforcement (attention) for hoarding. There will be a full supply of magazines in the dayroom. Every night, after all patients have gone to bed, replenish the magazine supply in the dayroom. Every night while the patients are in bed, check their clothes to record the amount of hoarding. Do not, however, take their hoarding from them."

The original plan was to count the number of magazines in the patients' clothing after they had gone to bed. This is, in fact, the dependent variable shown in Fig. 5 for Joe, Tom, and Mac. The recording for Harry had to be changed, however; after 4 days of the program, he no longer carried the rubbish or magazines in his clothing. Instead, he kept a stack of magazines on his lap while he was sitting in the dayroom. The number of magazines in his stack was counted when he left the dayroom for supper, and this is the dependent variable shown for Harry in Fig. 5. (Mac was out of the ward for 3 weeks because of illness.)

Prior to the program, one of the nurses questioned the possibility and even advisability of changing Harry's behavior. Her argument was that "behavior has its roots in the personality of the individual. The fact that he hoards so much indicates that Harry has a strong need for security. I don't see how we are going to change this need, and I also wonder if it is a good thing to do that." This was a point of view commonly encountered, especially regarding relatively nonverbal patients.

It would seem in this case that Harry transferred his security needs from hoarding rubbish and magazines to sitting in the dayroom and looking at magazines, especially during T.V. commercials. The transfer occurred with no apparent signs of discomfort on his part.

OTHER CASES

Combinations of extinction, reinforcement, and avoidance programs were set up for three patients; in two of these the problem behavior was eliminated in only a few weeks. The program of the third patient was followed for 20 days and then terminated since he had shown no changes by that time. An interpretation of the outcome of each of these programs is rendered questionable by the number of controlling variables involved and the nature of the changes.

The pretreatment study of four additional patients showed that the problem behavior of three of them did not occur often enough to justify carrying through a program; and in the fourth case, no easily controllable variables were available and, again, no program was undertaken.

DISCUSSION

On the basis of this work, further research along the same lines is now under way.[4] The present results are presented in this preliminary form in the hopes that they will provide encouragement to those who are in a position to conduct similar research. . . .

REFERENCES

Ayllon, T. The application of reinforcement theory to ward behavior problems. Unpublished doctoral dissertation, University of Houston, 1959.

Ferster, C. B., and Skinner, B. F. *Schedules of reinforcement*. New York: Appleton-Century-Crofts, 1957.

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[4] This new project is supported by a grant from the Commonwealth Fund, and is being conducted under the auspices of the Saskatchewan Hospital, Weyburn, Saskatchewan, Canada.

45.

Control of the Behavior of Schizophrenics by Food*[1]

Teodoro Ayllon[2] and Eric Haughton[3]

Operant-conditioning principles using food as a reinforcer were applied to control the behavior of 45 chronic schizophrenic patients. The investigation was conducted in a psychiatric ward in which there was 24-hr environmental control.

In order to use food as a reinforcer for controlling psychotic behavior, it was necessary first to deal with the eating deficits in the patients. Approximately 50% of the ward population was selected because of a history of refusal to eat. Their refusal to eat had remained relatively unaffected by one or more of these treatments: spoonfeeding, tubefeeding, intravenous feeding, and electroshock. These treatments were discontinued, and the patients were left alone at mealtimes. The results show that social reinforcement in such forms as coaxing, persuading, and feeding the patient tend to shape patients into eating problems so they are conditioned to eat only with assistance. When refusal to eat was no longer followed by social reinforcement, the patients soon started eating unassisted. When access to the dining room was made dependent upon a chain of responses including a motor and social component, all patients learned these responses.

Attempts to control the behavior of schizophrenic patients have relied heavily on the use of reinforcers such as candy, cigarettes, and money (Lindsley, 1956; King, *et al.*, 1957; Hutchinson & Azrin, 1961). To improve the limited effectiveness of these reinforcers, Lindsley (1956) studied the reinforcing characteristics of a wide range of stimuli. For example, he has used such reinforcers as religious pictures, auditory feedback, and music. These reinforcers have proved to be effective for some individuals, but not appropriate for general use. In research with humans, a powerful reinforcer is greatly

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* From T. Ayllon and E. Haughton, Control of the behavior of schizophrenics by food, *J. exp. anal. Behav.*, **5,** 343–352 (1962). Reprinted by permission of the authors and the *Journal of the Experimental Analysis of Behavior*.

[1] This report is based, in part, on a 2-year research project conducted at the Saskatchewan Hospital, Weyburn, Saskatchewan, Canada, and supported by a grant from the Commonwealth Fund. Grateful acknowledgment is due to H. Osmond and I. Clancey of the Saskatchewan Hospital for making the research possible at this institution. The advice and criticisms of J. Michael, I. Goldiamond, and N. Azrin are also greatly appreciated.

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[3] Now at Psychological Laboratories, Harvard University, Cambridge, Massachusetts.

needed which will have general application irrespective of such variables as age, intelligence, or psychological deficits. One such reinforcer is food.

The advantages of using food as a reinforcer are self-evident. Indeed, the control of psychotic behavior may be made more effective by making food contingent upon desired behaviors. Since most experimenters are keenly aware of the possibilities of food as a reinforcer one may well wonder why it has not been used. The most probable reason is the administrative difficulties encountered in controlling food in the patient's environment.

As part of a programmatic research in the development of techniques for the control of psychotic behavior, we attempted using food as a reinforcer. However, in the planning stages of this investigation, we learned that a number of schizophrenic patients refused food and required special treatments to prevent possible starvation. Therefore, attempting to use food as a reinforcer of general application seemed unreasonable. An inquiry indicated that "eating problems" were often regarded as symptoms of the patient's "mental condition." Many of these patients exhibited delusions or made peculiar statements regarding food. For instance, some insisted the food was poisoned, others claimed God forbade them to eat, and so on. Frequently, a "dynamic" interpretation was found in the patient's file to explain his refusal to eat. Other times, "psychotic intrusions" and lack of "reality contact" or "ego identification" were also advanced as explanations. All of these interpretations seemed to point to one conclusion: eating problems can be modified only if the patient's mental state is modified first.

Refusal to eat is observed in most mental hospitals. The treatment varies from hospital to hospital, and, indeed, from ward to ward. Often, a patient requires only a personal "reminder," such as when the nurse[4] looks for the patient at mealtimes and lets him know that he had better go to the dining room to eat. Other times, the nurse takes the patient by the hand to eat. If the patient complains of the food being poisoned, the nurse may ingest a few spoonfuls and say, "Look, I'm eating the same food you have; you can see it is not poisoned." If the patient's eating behavior remains unaltered, spoonfeeding, tubefeeding, intravenous feeding, and electroshock treatments are often used. Although the patient may start eating after any or all of these treatments, many patients do so only for short periods of time. Those patients who require "constant supervision" are regarded as chronic eating problems.

Such considerations form the background for the problems concerning the schizophrenic's eating behavior. Clearly then, we had to first determine if food alone would control normal eating behavior in schizophrenic subjects, including those patients known as chronic eating problems. Only then could we proceed to study the effects of food as a reinforcer.

The Experimental Ward and Control over the Reinforcement

This study was conducted in a mental hospital ward, to which only authorized personnel were allowed access. The dining room was the only place where food was available, and entrance to the dining room was under full experimental control. Water was freely available at a drinking fountain on the ward. None of the patients had ground passes or jobs outside the ward.

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[4] As used in this paper, "nurse" is a generic term, including all those who actually work on the ward (attendants, aides, and psychiatric and registered nurses).

Experiment I: Control of Normal Eating Behavior of Schizophrenic Patients by Food

SUBJECTS

The Ss were 32 female patients in a mental hospital. Seven of these patients were selected solely because they were regarded as eating problems and because they were able to walk. Before they were admitted to the experimental ward, these patients had been spoonfed, tubefed, or given electroshock therapy when they refused to eat. The remaining 25 patients were selected at random from a population of long-standing schizophrenic patients. The median for continuous hospitalization for all patients was 20 years. The median age for the group was 54 years. The diagnostic categories for the patients were: 30 schizophrenics, 1 mental defective, and 1 patient suffering from involutional depression.

No medications were given to 28 of the 32 Ss during the investigation. Phenothiazine derivatives were administered to 4 patients.

PROCEDURE

The traditional treatments for eating problems were discontinued. Patients were no longer coaxed, reminded, led, or escorted to eat. They were not spoonfed, tubefed or subjected to electroshock therapy.

In order to bring eating behavior under the sole control of food, the nurses were kept away from the patients at mealtimes. In so doing, the social reinforcement in the form of attention and sympathy for refusal to eat was removed. If the patient was to eat a meal, she had to walk into the dining room without any coaxing, persuasion, or guidance from the nurses. To insure objectivity of recording, the response recorded was "entering the dining room." Eating invariably followed this response; therefore, the terms eating and entering the dining room are used interchangeably.

At mealtime, a time interval of 30 min was allowed for the patients to be admitted to the dining room. Patients were not told of the time limit. A nurse called the meal and opened the dining room; and at the end of the 30-min interval, the door was locked and no patients were allowed to enter.

RESULTS

The eating problems of the schizophrenic patients were eliminated. As Fig. 1 shows, the patients with eating problems showed a low percentage of meals eaten upon the removal of all assistance for taking meals. These patients maintained a stable percentage of eating when access to the dining room was limited to 30 min. After 4 weeks, only 20 min of access to the dining room was allowed. Under this reduced access time, the patients still maintained a stable eating behavior. Even when only 15 min of access time was allowed, the patients continued eating their meals. The time limit for entering the dining room was then reduced further to 5 min. Only under this stringent requirement did the patients show a slight temporary drop in the percentage of meals eaten. The rest of the ward patients showed a similar stability in the percentage of meals eaten, and also a slight drop when the time limit for access to meals was lowered to 5 min. The main difference between these two groups of patients lies in the overall percentage of meals eaten.

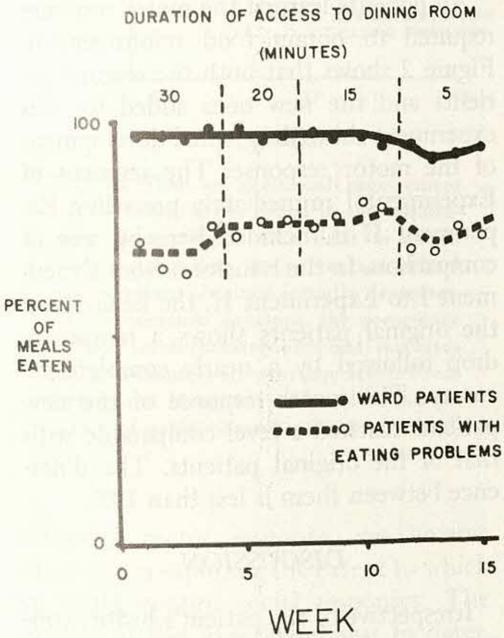

FIG. 1. The unassisted eating by mental patients. All assistance, persuasion, and spoonfeeding at mealtimes were removed. Following meal call, access to the dining room was gradually reduced from 30 min to 20, to 15, and, finally, to 5 min. From Ayllon and Haughton: Control of the behavior of schizophrenic patients by food.

The eating behavior of two patients differed somewhat from that of the rest of the patients. One patient stopped eating for 7 days, and then was given milk, concentrated protein, and multivitamins intermittently. In time, she was maintained on a fluid diet of 1200 to 1500 calories per day, and received this at the same time other patients received medications. She was kept on this regimen for 110 days, so that she lost 18% of her body weight. Thereafter, she started going to the dining room. Another patient who suffered from obesity stopped eating for 15 days, drinking only water during this time. At the end of this fast, she had lost most of her excess weight (15% of the original weight). At this time, she resumed going to the dining room with all of the other patients.

DISCUSSION

These findings demonstrate that the control of the eating behavior of schizophrenic patients by food alone is feasible. Even patients who fasted for long periods eventually came under the control of food. . . .

Neither psychiatric diagnosis nor body weight were related to the development of eating problems. For example, some schizophrenic as well as mental defective patients had a history of eating difficulties. Likewise, a subject weighing over 200 pounds had a long history of refusing to eat, and so did a subject of 75 pounds. Fears concerning the imminent danger of starvation in lightweight subjects were unfounded. Both heavy and lightweight Ss eventually ate when refusal to eat was no longer followed by social reinforcement.

These results lead to two conclusions: 1) problem eaters are actually encouraged (shaped) by their social environment to refuse food; and 2) food is a sufficient reinforcer to control normal eating behavior of schizophrenic patients.

Experiment II: Control of the Motor Behavior of Schizophrenic Patients by Food

SUBJECTS

After we had proved that patients will eat, we were now in a position to use food as a reinforcer in the development of motor responses.

In order to increase the generality of our findings about the control of normal eating by food, 6 patients regarded as feeding problems were added to the previous group. This addition made a total of 38 patients, 13 of whom were selected because of a history of refusing food. The median length of hospitalization for these 6 patients was 16 years; their median age was 49 years. All 6 *Ss* were diagnosed as schizophrenic. One *S* received barbiturates, and the other 5 *Ss* received no medication.

PROCEDURE

The patients were required to drop a penny into the slot of a collection can to gain entrance to the dining room. In addition, access to the dining room was limited to 5 min from the time of meal call. The development of the coin as an S^D for entering the dining room was begun by having a nurse distribute a penny to each of the patients congregated outside the dining room door at mealtime.

In anticipation of difficulty, some shaping was used in this experiment. The first day of Experiment II, the 5-min access to the dining room was increased to 10 min per meal. However, after the second day, the time interval was again reduced to, and maintained at, 5-min. The nurses also used verbal shaping on the first day. The nurse told the patients, "Give this penny to the nurse when you go to eat." When the dining room door was opened, another nurse stopped the patients at the door with, "Drop the penny in the collection can, please." (The nurse pointed to the can placed outside the dining-room door.)

RESULTS

All patients learned the motor response required to obtain food reinforcement. Figure 2 shows that both the original patients and the new ones added for this experiment showed a gradual development of the motor response. The segment of Experiment I immediately preceding Experiment II is included here by way of comparison. In the transition from Experiment I to Experiment II, the behavior of the original patients shows a temporary drop followed by a nearly complete recovery. The motor response of the new patients reached a level comparable with that of the original patients. The difference between them is less than 10%.

DISCUSSION

Irrespective of the patient's history concerning eating, all patients learned the motor response. The acquisition of motor behavior was gradual for both the original and new patients. Initially, patients displayed behaviors which suggested the difficulties in developing the penny as a discriminative stimulus. . . .

Experiment III: Control of the Social Behavior of Schizophrenic Patients by Food

SUBJECTS

Once we had proved that schizophrenics can be conditioned to execute a

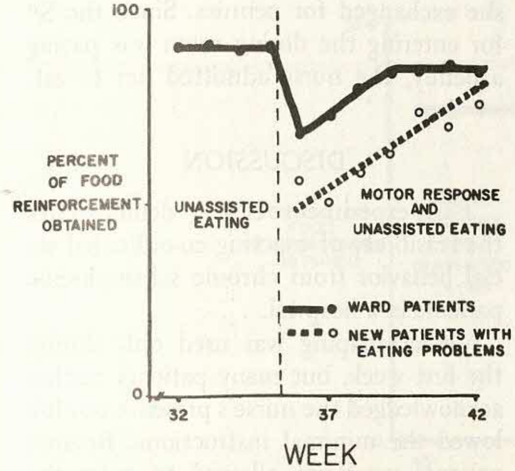

FIG. 2. When an additional requirement (motor response) is added to the requirement of meeting a time limit to obtain food reinforcement, the percentage of food reinforcement obtained initially decreases. As the response develops, the percentage of food reinforcement obtained increases to approximately its previous level. From Ayllon and Haughton: Control of the behavior of schizophrenic patients by food.

nonsocial motor response, we became interested in exploring the extent to which we could control social responses. The purpose of this experiment was to determine whether schizophrenics could be conditioned to cooperate with one another when the reinforcer is food.

Two patients who had been in Experiments I and II were excluded from Experiment III. The first patient was excluded because of a broken bone which required that she leave the ward; the other patient was transferred to another ward for routine tuberculosis check-up. Seven more patients with a history for being helped to eat were added for this experiment. This addition made a total of 43 patients, 20 of whom were selected because of a history of refusing food.

For the 5 years preceding admission to the experimental ward, all seven additional patients were assisted regularly to eat their meals. Five of these patients had been given a food tray on the ward at mealtime. The food tray was placed on a table in front of the patient while a nurse sat with her to supervise her eating. Because these patients had eaten under these circumstances, the nurses had not regarded them as eating problems. The other two patients had been taken by the hand to the dining room to eat, and were intermittently spoonfed until they started to eat by themselves.

The median length of hospitalization for the seven additional patients was 21 years; their median age was 55 years. Five patients were diagnosed as schizophrenic, and two were diagnosed as mental defective. Only two of these patients received medication: one received a phenothiazine derivative; and the other, barbiturates.

PROCEDURE

In Experiment II, all patients learned to execute the motor response that admitted them into the dining room, e.g., obtaining the penny from the nurse and dropping it into the slot. After the penny was established as the S^D for admission to the dining room, the next step was to make receipt of the penny dependent upon a cooperative response between two patients.

For the present experiment, a device was designed which functioned upon the co-ordinated effort of two people; thus, the term "social response." The device consisted of a table with one doorbell button at each end and a red light and buzzer in the middle. When the two buttons were pressed simultaneously, the light-buzzer came on. When only one was pressed, the light-buzzer remained off. Since the buttons were 7½ ft apart, one person could not press both of them at the same time.

To allow sufficient time for the proper execution of the social response, the device was available for the 5 min immediately preceding the meal call, and also during the 5-min duration of access to the dining room. Verbal shaping was used the first week to facilitate learning the response. The instructions used to shape the patients were minimal; e.g., "Push the button and see what happens," or "It takes two people to make the buzzer go." When two patients pressed the buttons, the light-buzzer came on and the nurse handed a penny to each "partner."

This social response enabled the patients to obtain the coin, but did not allow them free access to the dining room. Admission to the dining room required that the patient also insert the penny into the slot. Hence, the social response was required in addition to the motor response.

RESULTS

The original patients, as well as the new ones added for this experiment, learned the social response necessary to obtain the coin; when they inserted the coin into the can, they had access to food reinforcement.

Figure 3 shows that after the 1-week period of response shaping, both groups showed a gradual development of the social response. Again, in the transition from one behavioral requirement to another, an initial temporary drop in the behavior was observed. Only one patient failed to develop the social response. This patient continued paying for meals by finding pennies, and even dimes, which she exchanged for pennies. Since the S^D for entering the dining room was paying a penny, the nurse admitted her to eat.

DISCUSSION

This experiment clearly demonstrates the feasibility of exacting co-ordinated social behavior from chronic schizophrenic patients in a hospital. . . .

Verbal shaping was used only during the first week, but many patients neither acknowledged the nurse's presence nor followed the minimal instructions. Because patients were not allowed to enter the dining room without first inserting a penny, most went immediately to the table where patients were pressing the buttons. Some patients tried pressing the button in the absence of a "partner." Since nothing happened, a few banged the table, others walked away, and still others remained pressing the button until someone managed to press the opposite button. In a short time, there were two lines of patients, one behind each button.

The social responses necessary to gain access to meals produced other related responses. These were largely verbal responses directed to patients or to the nurses. Verbal behavior among patients centered about giving or receiving mutual help and information regarding the execution of the social response. . . .

The results of this experiment were very surprising to the staff. Because virtually all of the patients were regarded as chronic, and "out of reality contact," it seemed useless to expect them to be aware of each other. Because many patients exhibited hallucinations, e.g., gesticulating and talking incessantly in the absence of a visible audience, it seemed unreasonable to the staff to expect these patients to interrupt their psychotic symptoms in

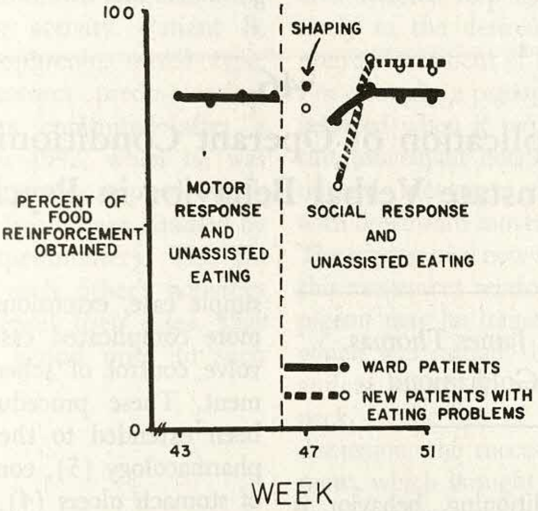

FIG. 3. When an additional requirement (social response) is added to the requirement of meeting a time limit and making a motor response, the percentage of food reinforcement obtained initially decreases. As the response develops, the percentage of food reinforcement obtained increases to approximately its previous level. Development of the social response required some shaping. From Ayllon and Haughton: Control of the behavior of schizophrenic patients by food.

time to engage in the social response demanded in this experiment. Finally, the experiment was regarded as so stressful for the patients that a "wave" of eating problems, particularly among those with a long history of such behavior, was anticipated. None of these apprehensions was supported by our results. By the deliberate, controlled scheduling of consequences, the patients learned the appropriate responses. . . .

REFERENCES

Ayllon, T., and Michael, J. The psychiatric nurse as a behavioral engineer. *J. exp. Anal. Behav.*, 1959, **2,** 323–334.

Ayllon, T. Some behavioral problems associated with eating in chronic schizophrenic patients. Paper read at American Psychological Assn., Chicago, September, 1960.

Azrin, N. H., and Lindsley, O. R. The reinforcement of co-operation between children. *J. Abnorm. and Soc. Psychol.*, 1956, **52,** 100–102.

Hutchinson, R. R., and Azrin, N. H. Conditioning of mental-hospital patients to fixed-ratio schedules of reinforcement. *J. exp. Anal. Behav.*, 1961, **4,** 87–95.

King, G. F., Merrell, D. W., Lovinger, E., and Denny, M. R. Operant motor behavior in acute schizophrenics. *J. Person.*, 1957, **25,** 317–326.

Lindsley, O. R. Operant conditioning methods applied to research in chronic schizophrenics. *Psychiat. res. Repts.*, 1956, **5,** 118–139, 147–153.

46.

Application of Operant Conditioning to Reinstate Verbal Behavior in Psychotics*[1]

Wayne Isaacs, James Thomas, and Israel Goldiamond

In operant conditioning, behavior is controlled by explicitly arranging the consequences of the response, the explicit consequence being termed reinforcement. For example, a lever-press by a rat activates a mechanism which releases food. If the rat has been deprived of food, lever-pressing responses will increase in frequency. If this relationship between food and response holds only when a light is on, the organism may discriminate between light on and light off, that is, there will be no lever-pressing responses when the light is turned off, but turning it on will occasion such responses. From this simple case, extensions can be made to more complicated cases which may involve control of schedules of reinforcement. These procedures have recently been extended to the study of psychopharmacology (*5*), controlled production of stomach ulcers (*4*), obtaining psychophysical curves from pigeons (*3*), conditioning cooperative behavior in children (*2*), programming machines which teach academic subjects (*11*), analyzing the effects of noise on human behavior (*1*), and decreasing stuttering (*7*), to mention a few examples.

The following account is a preliminary report of the use of operant conditioning to reinstate verbal behavior in two hospitalized mute psychotics. Patient A, classified as a catatonic schizophrenic, 40, became completely mute almost immediately upon commitment 19 years ago. He

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* From W. Isaacs, J. Thomas, and I. Goldiamond, Application of operant conditioning to reinstate verbal behavior in psychotics, *J. speech hearing Disorders*, **25,** 8–12 (1960). Reprinted by permission of the authors and the *Journal of Speech and Hearing Disorders*.

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was recorded as withdrawn and exhibiting little psychomotor activity. Patient B, classified as schizophrenic, mixed type, with catatonic features predominating, was 43, and was commited after a psychotic break in 1942, when he was combative. He completely stopped verbalizing 14 years ago. Each *S* was handled by a different *E* (experimenter). The *E*'s were ignorant of each other's activities until pressed to report their cases. This study covers the period prior to such report.

Case Histories

PATIENT A

The *S* was brought to a group therapy session with other chronic schizophrenics (who were verbal), but he sat in the position in which he was placed and continued the withdrawal behaviors which characterized him. He remained impassive and stared ahead even when cigarettes, which other members accepted, were offered to him and were waved before his face. At one session, when *E* removed cigarettes from his pocket, a package of chewing gum accidentally fell out. The *S*'s eyes moved toward the gum and then returned to their usual position. This response was chosen by *E* as one with which he would start to work, using the method of successive approximation (9). (This method finds use where *E* desires to produce responses which are not present in the current repertoire of the organism and which are considerably removed from those which are available. The *E* then attempts to 'shape' the available behaviors into the desired form, capitalizing upon both the variability and regularity of successive behaviors. The shaping process involves the reinforcement of those parts of a selected response which are successively in the desired direction and the nonreinforcement of those which are not. For example, a pigeon may be initially reinforced when it moves its head. When this movement occurs regularly, only an upward movement may be reinforced, with downward movement not reinforced. The pigeon may now stretch its neck, with this movement reinforced. Eventually the pigeon may be trained to peck at a disc which was initially high above its head and at which it would normally never peck. In the case of the psychotic under discussion, the succession was eye movement, which brought into play occasional facial movements, including those of the mouth, lip movements, vocalizations, word utterance, and finally, verbal behavior.)

The *S* met individually with *E* three times a week. Group sessions also continued. The following sequence of procedures was introduced in the private sessions. Although the weeks are numbered consecutively, they did not follow at regular intervals since other duties kept *E* from seeing *S* every week.

Weeks 1, 2. A stick of gum was held before *S*'s face, and *E* waited until *S*'s eyes moved toward it. When this response occurred, *E* as a consequence gave him the gum. By the end of the second week, response probability in the presence of the gum was increased to such an extent that *S*'s eyes moved toward the gum as soon as it was held up.

Weeks 3, 4. The *E* now held the gum before *S*, waiting until he noticed movement in *S*'s lips before giving it to him. Toward the end of the first session of the third week, a lip movement spontaneously occurred, which *E* promptly reinforced. By the end of this week, both lip movement and eye movement occurred when the gum was held up. The *E* then withheld giving *S* the gum until *S* spontaneously made a vocalization, at which time *E* gave *S* the gum. By the end of this week, holding up the gum readily occasioned eye movement toward it, lip movement, and a vocalization resembling a croak.

Weeks 5, 6. The *E* held up the gum, and said, 'Say *gum, gum*,' repeating these words each time *S* vocalized. Giving *S* the gum was made contingent upon vocalizations increasingly approximating *gum*. At the sixth session (at the end of Week 6), when *E said*, 'Say *gum, gum*,' *S* suddenly said, 'Gum, please.' This response was accompanied by reinstatement of other responses of this class, that is, *S* answered questions regarding his name and age.

Thereafter, he responded to questions by *E* both in individual sessions and in group sessions, but answered no one else. Responses to the discriminative stimuli of the room generalized to *E* on the ward; he greeted *E* on two occasions in the group room. He read from signs in *E*'s office upon request by *E*.

Since the response now seemed to be under the strong stimulus control of *E*, *the person*, attempt was made to generalize the stimulus to other people. Accordingly, a nurse was brought into the private room; *S* smiled at her. After a month, he began answering her questions. Later, when he brought his coat to a volunteer worker on the ward, she interpreted the gesture as a desire to go outdoors and conducted him there. Upon informing *E* of the incident, she was instructed to obey *S* only as a consequence of explicit verbal requests by him. The *S* thereafter vocalized requests. These instructions have now been given to other hospital personnel, and *S* regularly initiates verbal requests when nonverbal requests have no reinforcing consequences. Upon being taken to the commissary, he said, 'Ping pong,' to the volunteer worker and played a game with her. Other patients, visitors, and members of hospital-society-at-large continue, however, to interpret nonverbal requests and to reinforce them by obeying *S*.

PATIENT B

This patient, with a combative history prior to mutism, habitually lay on a bench in the day room in the same position, rising only for meals and for bed. Weekly visits were begun by *E* and an attendant. During these visits, *E* urged *S* to attend group therapy sessions which were being held elsewhere in the hospital. The *E* offered *S* chewing gum. This was not accepted during the first two visits, but was accepted on the third visit and thereafter. On the sixth visit, *E* made receipt of the gum contingent upon *S*'s going to the group room and so informed *S*. The *S* then altered his posture to look at *E* and accompanied him to the group room, where he seated himself in a chair and was given the gum. Thereafter, he came to this room when the attendants called for him.

Group Sessions 1–4. Gum reinforcement was provided for coming to the first two weekly sessions, but starting with the third, it was made contingent upon *S*'s participation in the announced group activity. The group (whose other members were verbal) was arranged in a semicircle. The *E* announced that each *S* would, when his turn came, give the name of an animal. The *E* immediately provided gum to each *S* who did so. The *S* did not respond and skipped his turn three times around. The same response occurred during the fourth session.

Group Session 5. The activity announced was drawing a person; *E* provided paper and colored chalk and visited each *S* in turn to examine the paper. The *S* had drawn a stick figure and was reinforced with gum. Two of the other patients, spontaneously and without prior prompting by *E*, asked to see the drawing and complimented *S*. Attendants reported that on the following day, *S*, when introduced to two ward visitors, smiled and said, 'I'm glad to see you.' The incident was followed by no particular explicit consequences.

Group Session 6. The announced activity was to give the name of a city or town in Illinois. The *S*, in his turn, said, 'Chicago.' He was reinforced by *E*, who gave him chewing gum, and again two members of the group congratulated him for responding. Thereafter, he responded whenever his turn came.

After the tenth session in the group, gum reinforcement was discontinued. The *S* has continued to respond vocally in the situations in which he was reinforced by *E* but not in others. He never initiates conversations, but he will answer various direct questions in the *group sessions*. He will not, however, respond vocally to questions asked *on the ward*, even when put by *E*.

DISCUSSION

Both *S*'s came from special therapy wards of patients selected because of depressed verbal behavior and long stay in the hospital; tranquilizing drugs were not used. The extent to which reinstatement of verbal behavior was related to the special treatment offered the patients in the special wards set up for them cannot readily be assayed. Among the special treatments accorded them were group therapy sessions. Nevertheless, the similarities between the pattern of reacquisition of verbal behavior by the patients and the patterns of learning encountered in laboratory studies suggest that the conditioning procedures themselves were involved in the reinstatement of verbal behavior.

In the case of Patient A, the speaking response itself was gradually shaped. The anatomical relation between the muscles of chewing and speaking probably had some part in *E*'s effectiveness. When a word was finally produced, the response was reinstated along with other response members of its class, which had not been reinforced. The economy of this process is apparent, since it eliminates the necessity of getting *S* to produce *every* desired response in order to increase his repertoire. In this case, *E* concentrated on one verbal response, and in reinstating it, reinstated verbal responses in general. On the stimulus side, when the response came under the stimulus control of *E*, the stimulus could be generalized to other members of *E*'s class of discriminative *stimuli*, namely, people. This may have relevance for the clinical inference of the importance for future interpersonal relations of prior identification with some person. In the case of Patient B, the stimulus control involved a *given setting*, the rooms where he had been reinforced. The discrimination of *E* in one case, and not in the other, may be explained in terms of the establishment of operant discrimination, which also involves extinction (9). Operant discrimination is established when a response in the presence of S^D, a discriminative stimulus, is reinforced, and a response in the presence of S^Δ, a stimulus other than S^D, is not. After some time, the response will occur when S^D is presented, but not when S^Δ is presented; the response discriminates S^D from S^Δ, it having been extinguished when S^Δ was presented. In the case of Patient A, *E* was with *S* on the ward, in the group room, and privately. Reinforcement occurred in all occasions. But *S* was on the ward (and other rooms) without *E*, and therefore without reinforcement for those responses which were occasioned by the ward and which only *E* reinforced. Hence, these responses would extinguish in the ward alone, but would continue in the presence of *E*, defining discrimination of *E* from other stimuli. In the case of Patient B, this process may have been delayed by the fact that *E* and the other patients reinforced only in a specific room. It will be recalled that attendants rather than *E* brought *S* to the group room.

Interestingly, in the group sessions, when Patient B emitted the responses which *E* reinforced, other psychotic patients also reinforced Patient B. They were thereby responding, on the occasion of *S*'s responses (discriminative stimuli for them), in the same way that *E* did. The term *identification*, used as a label here, shares some behavioral referents with the term as used in the preceding paragraph and might be explained behaviorally in terms of the *generalized reinforcer* (*10*). These behaviors by the patients are similar to behaviors reported in client-centered group sessions, where clients increase in reflective behaviors as counseling progresses, and in psychoanalytic group sessions, where patients increasingly make analytic interpretations of each other. Here, the patients are also behaving like the therapist. While this parallel lends itself to the facetious thought that operant group sessions may produce operant conditioners, it does suggest that psychotics are behaving, with regard to responses by the major source of reinforcement in the group, according to the same laws which govern such group behaviors of nonhospitalized *S*'s.

The various diagnostic labels applied to psychotics are based to a considerable extent upon differences between responses considered abnormal, for example, hallucinations, delusions of persecution, and the like. The therapeutic process is accordingly at times seen in terms of eliminating the abnormal behaviors or states. Experimental laboratory work indicates that it is often extremely difficult to *eliminate* behavior; extinction is extremely difficult where the schedule of reinforcement has been a variable interval schedule (*6*), that is, reinforcement has been irregular, as it is in most of our behaviors. Such behaviors persist for considerable periods without reinforcement. Experimental laboratory work has provided us quite readily with procedures to *increase* responses. In the case of psychotics, this would suggest focusing attention on whatever *normal* behaviors *S* has; an appropriate operant, no matter how small or insignificant, even if it is confined to an eye movement, may possibly be raised to greater probability, and shaped to normal behavior (*8*). Stated otherwise, abnormal behaviors and normal behaviors can be viewed as reciprocally related, and psychotics as exhibiting considerable abnormal behavior, or little normal behavior. Normal behavior probability can be increased by decreasing probability of abnormal behaviors, or abnormal behaviors can be decreased by the controlled increase of normal behaviors. This preliminary report suggests that a plan of attack based upon the latter approach may be worth further investigation.

SUMMARY

Verbal behavior was reinstated in two psychotics, classified as schizophrenics, who had been mute for 19 and 14 years. The procedures utilized involved application of operant conditioning. The relationship of such procedures, based on controlled laboratory investigations with men and animals, to procedures based on clinical practice with human patients was discussed and was considered as directing our attention to shaping and increasing the probability of what normal behaviors the psychotic possesses.

ACKNOWLEDGMENTS

The authors wish to express their appreciation to Dr. Leonard Horecker, Clinical Director of Anna State Hospital, and to Dr. Robert C. Steck, Hospital Superintendent, for their encouragement and facilitation of the project. This investigation was supported in part by a grant from the Psychiatric Training and Research Fund of the Illinois Department of Public Welfare.

REFERENCES

1. Azrin, N. H. Some effects of noise on human behavior. *J. exp. Anal. Behavior*, 1958, **1**, 183–200.
2. Azrin, N. H., and Lindsley, O. R. The reinforcement of cooperation between children. *J. abnorm. (soc.) Psychol.*, **52**, 1956, 100–102.
3. Blough, D. S. A method for obtaining psychophysical thresholds from the pigeon. *J. exp. Anal. Behavior*, 1958, **1**, 31–44.
4. Brady, J. V. Ulcers in 'executive' monkeys. *Sci. Amer.*, 1958, 199(4), 95–100.
5. Dews, P. B. The effects of chlorpromazine and promazine on performance on a mixed schedule of reinforcement. *J. exp. Anal. Behavior*, 1958, **1**, 73–82.
6. Ferster, C. B., and Skinner, B. F. *Schedules of Reinforcement*. New York: Appleton-Century-Crofts, 1957.
7. Flanagan, B., Goldiamond, I., and Azrin, N. H. Operant stuttering: the control of stuttering behavior through response-contingent consequences. *J. exp. Anal. Behavior*, 1958, **1**, 173–178.
8. Goldiamond, I. Research which can be done in a mental hospital. Address delivered to Illinois State Mental Hospitals Conference, Giant City State Park, Illinois, 1958.
9. Keller, F., and Schoenfeld, W. *Principles of Psychology*. New York: Appleton-Century-Crofts, 1950.
10. Skinner, B. F. *Science and Human Behavior*. New York: Macmillan, 1953.
11. Skinner, B. F. Teaching machines. *Science*, 1958, **128**, 969–977.

47.

The Elimination of Tantrum Behavior by Extinction Procedures*

Carl D. Williams

This paper reports the successful treatment of tyrant-like tantrum behavior in a male child by the removal of reinforcement. The subject (S) was approximately 21 months old. He had been seriously ill much of the first 18 months of his life. His health then improved considerably, and he gained weight and vigor.

S now demanded the special care and attention that had been given him over the many critical months. He enforced some of his wishes, especially at bedtime, by unleashing tantrum behavior to control the actions of his parents.

The parents and an aunt took turns in putting him to bed both at night and for S's afternoon nap. If the parent left the bedroom after putting S in his bed, S would scream and fuss until the parent returned to the room. As a result, the parent was unable to leave the bedroom until after S went to sleep. If the parent began to read while in the bedroom, S would cry until the reading material was put down. The parents felt that S enjoyed his control over them and that he fought off going to sleep as long as he could. In any event, a parent was spending from one-half to two hours each bedtime just waiting in the bedroom until S went to sleep.

Following medical reassurance regarding S's physical condition, it was decided to remove the reinforcement of this tyrant-like tantrum behavior. Consistent with the learning principle that, in general, behavior that is not reinforced will be extinguished, a parent or the aunt put S to bed in a leisurely and relaxed fashion. After bedtime pleasantries, the parent left the bedroom and closed the door. S screamed and raged, but the parent did not re-enter the room. The duration of screaming and crying was obtained from the time the door was closed.

The results are shown in Fig. 1. It can be seen that S continued screaming for 45 min. the first time he was put to bed in the first extinction series. S did not cry at all the second time he was put to bed. This is perhaps attributable to his fatigue from the crying of Occasion 1. By the tenth occasion, S no longer whimpered, fussed, or cried when the parent left the room. Rather, he smiled as they left. The parents felt that he made happy sounds until he dropped off to sleep.

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* From C. D. Williams, The elimination of tantrum behavior by extinction procedures, *J. abnorm. soc. Psychol.*, **59**, 269 (1959). Reprinted by permission of the author and the American Psychological Association.

About a week later, *S* screamed and fussed after the aunt put him to bed, probably reflecting spontaneous recovery of the tantrum behavior. The aunt then reinforced the tantrum behavior by returning to *S*'s bedroom and remaining there until he went to sleep. It was then necessary to extinguish this behavior a second time.

Figure 1 shows that the second extinction curve is similar to the first. Both curves are generally similar to extinction curves obtained with subhuman subjects. The second extinction series reached zero by the ninth occasion. No further tantrums at bedtime were reported during the next two years.

It should be emphasized that the treatment in this case did not involve aversive punishment. All that was done was to remove the reinforcement. Extinction of the tyrant-like tantrum behavior then occurred.

No unfortunate side- or aftereffects of this treatment were observed. At three and three-quarters years of age, *S* appeared to be a friendly, expressive, outgoing child.

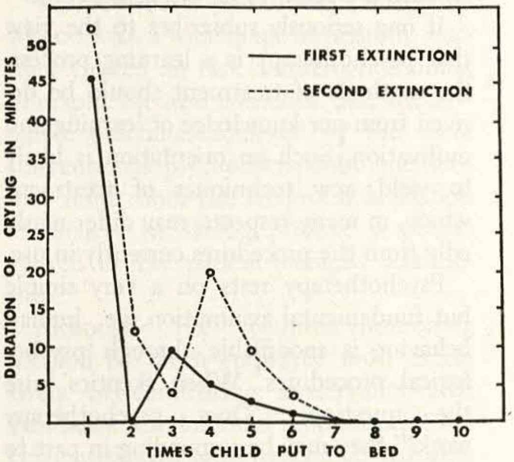

FIG. 1. Length of crying in two extinction series as a function of successive occasions of being put to bed. From Williams: The elimination of tantrum behavior by extinction procedures.

48.

Psychotherapy as a Learning Process*

Albert Bandura

While it is customary to conceptualize psychotherapy as a learning process, few therapists accept the full implications of this position. Indeed, this is best illustrated by the writings of the learning theorists themselves. Most of our current methods of psychotherapy represent an accumulation of more or less uncontrolled clinical experiences and, in many instances, those who have written about psychotherapy in terms of learning theory have merely substituted a new language; the practice remains essentially unchanged (Dollard, Auld, & White, 1954; Dollard & Miller, 1950; Shoben, 1949).

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* From A. Bandura, Psychotherapy as a learning process, *Psychol. Bull.*, **58**, 143–159 (1961). Reprinted by permission of the author and the American Psychological Association.

If one seriously subscribes to the view that psychotherapy is a learning process, the methods of treatment should be derived from our knowledge of learning and motivation. Such an orientation is likely to yield new techniques of treatment which, in many respects, may differ markedly from the procedures currently in use.

Psychotherapy rests on a very simple but fundamental assumption, i.e., human behavior is modifiable through psychological procedures. When skeptics raise the question, "Does psychotherapy work?" they may be responding in part to the mysticism that has come to surround the term. Perhaps the more meaningful question, and one which avoids the surplus meanings associated with the term "psychotherapy," is as follows: Can human behavior be modified through psychological means and if so, what are the learning mechanisms that mediate behavior change?

In the sections that follow, some of these learning mechanisms will be discussed, and studies in which systematic attempts have been made to apply these principles of learning to the area of psychotherapy will be reviewed. Since learning theory itself is still somewhat incomplete, the list of psychological processes by which changes in behavior can occur should not be regarded as exhaustive, nor are they necessarily without overlap.

Counterconditioning

Of the various treatment methods derived from learning theory, those based on the principle of counterconditioning have been elaborated in greatest detail. Wolpe (1954, 1958, 1959) gives a thorough account of this method, and additional examples of cases treated in this manner are provided by Jones (1956), Lazarus and Rachman (1957), Meyer (1957), and Rachman (1959). Briefly, the principle involved is as follows: if strong responses which are incompatible with anxiety reactions can be made to occur in the presence of anxiety evoking cues, the incompatible responses will become attached to these cues and thereby weaken or eliminate the anxiety responses.

The first systematic psychotherapeutic application of this method was reported by Jones (1924b) in the treatment of Peter, a boy who showed severe phobic reactions to animals, fur objects, cotton, hair, and mechanical toys. Counterconditioning was achieved by feeding the child in the presence of initially small but gradually increasing anxiety-arousing stimuli. A rabbit in a cage was placed in the room at some distance so as not to disturb the boy's eating. Each day the rabbit was brought nearer to the table and eventually removed from the cage. During the final stage of treatment, the rabbit was placed on the feeding table and even in Peter's lap. Tests of generalization revealed that the fear responses had been effectively eliminated, not only toward the rabbit, but toward the previously feared furry objects as well.

In this connection, it would be interesting to speculate on the diagnosis and treatment Peter would have received had he been seen by Melanie Klein (1949) rather than by Mary Cover Jones!

It is interesting to note that while both Shoben (1949) and Wolpe (1958) propose a therapy based on the principle of counterconditioning, their treatment methods are radically different. According to Shoben, the patient discusses and thinks about stimulus situations that are anxiety provoking in the context of an interpersonal situation which simultaneously elicits positive affective responses from the patient. The therapeutic process consists in connecting the anxiety provoking stimuli, which are symbolically reproduced, with the comfort reaction made to the therapeutic relationship.

Shoben's paper represents primarily a counterconditioning interpretation of the behavior changes brought about through conventional forms of psychotherapy since, apart from highlighting the role of positive emotional reactions in the treatment process, no new techniques deliberately designed to facilitate relearning through counterconditioning are proposed.

This is not the case with Wolpe, who has made a radical departure from tradition. In his treatment, which he calls reciprocal inhibition, Wolpe makes systematic use of three types of responses which are antagonistic to, and therefore inhibitory of, anxiety. These are: assertive or approach responses, sexual responses, and relaxation responses.

On the basis of historical information, interview data, and psychological test responses, the therapist constructs an anxiety hierarchy, a ranked list of stimuli to which the patient reacts with anxiety. In the case of desensitization based on relaxation, the patient is hypnotized and given relaxation suggestions. He is then asked to imagine a scene representing the weakest item on the anxiety hierarchy and, if the relaxation is unimpaired, this is followed by having the patient imagine the next item on the list, and so on. Thus, the anxiety cues are gradually increased from session to session until the last phobic stimulus can be presented without impairing the relaxed state. Through this procedure, relaxation responses eventually come to be attached to the anxiety evoking stimuli.

Wolpe reports remarkable therapeutic success with a wide range of neurotic reactions treated on this counterconditioning principle. He also contends that the favorable outcomes achieved by the more conventional psychotherapeutic methods may result from the reciprocal inhibition of anxiety by strong positive responses evoked in the patient-therapist relationship.

Although the counterconditioning method has been employed most extensively in eliminating anxiety-motivated avoidance reactions and inhibitions, it has been used with some success in reducing maladaptive approach responses as well. In the latter case, the goal object is repeatedly associated with some form of aversive stimulus.

Raymond (1956), for example, used nausea as the aversion experience in the treatment of a patient who presented a fetish for handbags and perambulators which brought him into frequent contact with the law in that he repeatedly smeared mucus on ladies' handbags and destroyed perambulators by running into them with his motorcycle. Though the patient had undergone psychoanalytic treatment, and was fully aware of the origin and the sexual significance of his behavior, nevertheless, the fetish persisted.

The treatment consisted of showing the patient a collection of handbags, perambulators, and colored illustrations just before the onset of nausea produced by injections of apomorphine. The conditioning was repeated every 2 hours day and night for 1 week plus additional sessions 8 days and 6 months later.

Raymond reports that, not only was

the fetish successfully eliminated, but also the patient showed a vast improvement in his social (and legal) relationships, was promoted to a more responsible position in his work, and no longer required the fetish fantasies to enable him to have sexual intercourse.

Nauseant drugs, especially emetine, have also been utilized as the unconditioned stimulus in the aversion treatment of alcoholism (Thirmann, 1949; Thompson & Bielinski, 1953; Voegtlen, 1940; Wallace, 1949). Usually 8 to 10 treatments in which the sight, smell, and taste of alcohol is associated with the onset of nausea is sufficient to produce abstinence. Of 1,000 or more cases on whom adequate follow-up data are reported, approximately 60% of the patients have been totally abstinent following the treatment. Voegtlen (1940) suggests that a few preventive treatments given at an interval of about 6 months may further improve the results yielded by this method.

Despite these encouraging findings, most psychotherapists are unlikely to be impressed since, in their opinion, the underlying causes for the alcoholism have in no way been modified by the conditioning procedure and, if anything, the mere removal of the alcoholism would tend to produce symptom substitution or other adverse effects. A full discussion of this issue will be presented later. In this particular context, however, several aspects of the Thompson and Bielinski (1953) data are worth noting. Among the alcoholic patients whom they treated, six "suffered from mental disorders not due to alcohol or associated deficiency states." It was planned, by the authors, to follow up the aversion treatment with psychotherapy for the underlying psychosis. This, however, proved unnecessary since all but one of the patients, a case of chronic mental deterioration, showed marked improvement and were in a state of remission.

Max (1935) employed a strong electric shock as the aversive stimulus in treating a patient who tended to display homosexual behavior following exposure to a fetishistic stimulus. Both the fetish and the homosexual behavior were removed through a series of avoidance conditioning sessions in which the patient was administered shock in the presence of the fetishistic object.

Wolpe (1958) has also reported favorable results with a similar procedure in the treatment of obsessions.

A further variation of the counter-conditioning procedure has been developed by Mowrer and Mowrer (1938) for use with enuretic patients. The device consists of a wired bed pad which sets off a loud buzzer and awakens the child as soon as micturition begins. Bladder tension thus becomes a cue for waking up which, in turn, is followed by sphincter contraction. Once bladder pressure becomes a stimulus for the more remote sphincter control response, the child is able to remain dry for relatively long periods of time without wakening.

Mowrer and Mowrer (1938) report complete success with 30 children treated by this method; similarly, Davidson and Douglass (1950) achieved highly successful results with 20 chronic enuretic children (15 cured, 5 markedly improved); of 5 cases treated by Morgan and Witmer (1939), 4 of the children not only gained full sphincter control, but also made a significant improvement in their social behavior. The one child with whom the conditioning approach had failed was later found to have bladder difficulties which required medical attention.

Some additional evidence for the efficacy of this method is provided by

Martin and Kubly (1955) who obtained follow-up information from 118 of 220 parents who had treated their children at home with this type of conditioning apparatus. In 74% of the cases, according to the parents' replies, the treatment was successful.

Extinction

"When a learned response is repeated without reinforcement the strength of the tendency to perform that response undergoes a progressive decrease" (Dollard & Miller, 1950). Extinction involves the development of inhibitory potential which is composed of two components. The evocation of any reaction generates reactive inhibition (I_r) which presumably dissipates with time. When reactive inhibition (fatigue, etc.) reaches a high point, the cessation of activity alleviates this negative motivational state and any stimuli associated with the cessation of the response become conditioned inhibitors ($_sI_r$).

One factor that has been shown to influence the rate of extinction of maladaptive and anxiety-motivated behavior is the interval between extinction trials. In general, there tends to be little diminution in the strength of fear-motivated behavior when extinction trials are widely distributed, whereas under massed trials, reactive inhibition builds up rapidly and consequently extinction is accelerated (Calvin, Clifford, Clifford, Bolden, & Harvey, 1956; Edmonson & Amsel, 1954).

An illustration of the application of this principle is provided by Yates (1958) in the treatment of tics. Yates demonstrated, in line with the findings from laboratory studies of extinction under massed and distributed practice, that massed sessions in which the patient performed tics voluntarily followed by prolonged rest to allow for the dissipation of reactive inhibition was the most effective procedure for extinguishing the tics.

It should be noted that the extinction procedure employed by Yates is very similar to Dunlap's method of negative practice, in which the subject reproduces the negative behaviors voluntarily without reinforcement (Dunlap, 1932; Lehner, 1954). This method has been applied most frequently, with varying degrees of success, to the treatment of speech disorders (Fishman, 1937; Meissner, 1946; Rutherford, 1940; Sheehan, 1951; Sheehan & Voas, 1957). If the effectiveness of this psychotherapeutic technique is due primarily to extinction, as suggested by Yates' study, the usual practice of terminating a treatment session before the subject becomes fatigued (Lehner, 1954), would have the effect of reducing the rate of extinction, and may in part account for the divergent results yielded by this method.

Additional examples of the therapeutic application of extinction procedures are provided by Jones (1955), and most recently by C. D. Williams (1959).

Most of the conventional forms of psychotherapy rely heavily on extinction effects although the therapist may not label these as such. For example, many therapists consider *permissiveness* to be a necessary condition of therapeutic change (Alexander, 1956; Dollard & Miller, 1950; Rogers, 1951). It is expected that when a patient expresses thoughts or feelings that provoke anxiety or guilt and the therapist does not disapprove, criticize, or withdraw interest, the fear or guilt will be gradually weakened or extinguished. The extinction effects are believed to generalize to thoughts concerning related topics that were originally inhibited, and to verbal and physical forms of behavior as well (Dollard & Miller, 1950).

Some evidence for the relationship between permissiveness and the extinction of anxiety is provided in two studies recently reported by Dittes (1957a, 1957b). In one study (1957b) involving an analysis of patient-therapist interaction sequences, Dittes found that permissive responses on the part of the therapist were followed by a corresponding decrease in the patient's anxiety (as measured by the GSR) and the occurrence of avoidance behaviors. A sequential analysis of the therapeutic sessions (Dittes, 1957a), revealed that, at the onset of treatment, sex expressions were accompanied by strong anxiety reactions; under the cumulative effects of permissiveness, the anxiety gradually extinguished.

In contrast to counterconditioning, extinction is likely to be a less effective and a more time consuming method for eliminating maladaptive behavior (Jones, 1924a; Dollard & Miller, 1950); in the case of conventional interview therapy, the relatively long intervals between interview sessions, and the ritualistic adherence to the 50-minute hour may further reduce the occurrence of extinction effects. . . .

Methods of Reward

Most theories of psychotherapy are based on the assumption that the patient has a repertoire of previously learned positive habits available to him, but that these adaptive patterns are inhibited or blocked by competing responses motivated by anxiety or guilt. The goal of therapy, then, is to reduce the severity of the internal inhibitory controls, thus allowing the healthy patterns of behavior to emerge. Hence, the role of the therapist is to create permissive conditions under which the patient's "normal growth potentialities" are set free (Rogers, 1951). The fact that most of our theories of personality and therapeutic procedures have been developed primarily through work with oversocialized, neurotic patients may account in part for the prevalence of this view.

There is a large class of disorders (the undersocialized, antisocial personalities whose behavior reflects a failure of the socialization process) for whom this model of personality and accompanying techniques of treatment are quite inappropriate (Bandura & Walters, 1959; Schmideberg, 1959). Such antisocial personalities are likely to present *learning deficits*, consequently the goal of therapy is the acquisition of secondary motives and the development of internal restraint habits. That antisocial patients prove unresponsive to psychotherapeutic methods developed for the treatment of oversocialized neurotics has been demonstrated in a number of studies comparing patients who remain in treatment with those who terminate treatment prematurely (Rubenstein & Lorr, 1956). It is for this class of patients that the greatest departures from traditional treatment methods is needed.

While counterconditioning, extinction, and discrimination learning may be effective ways of removing neurotic inhibitions, these methods may be of relatively little value in developing new positive habits. Primary and secondary rewards in the form of the therapist's interest and approval may play an important, if not indispensable, role in the treatment process. Once the patient has learned to want the interest and approval of the therapist, these rewards may then be used to promote the acquisition of new patterns of behavior. For certain classes of patients such as schizophrenics (Atkinson, 1957; Peters, 1953; Robinson, 1957) and delinquents (Cairns, 1959), who are either unresponsive to, or fearful of, social rewards, the therapist may have to rely initially on primary rewards in the treatment process.

An ingenious study by Peters and Jenkins (1954) illustrates the application of this principle in the treatment of schizophrenic patients. Chronic patients from closed wards were administered subshock injections of insulin designed to induce the hunger drive. The patients were then encouraged to solve a series of graded problem tasks with fudge as the reward. This program was followed 5 days a week for 3 months.

Initially the task involved simple mazes and obstruction problems in which the patients obtained the food reward directly upon successful completion of the problem. Tasks of gradually increasing difficulty were then administered involving multiple-choice learning and verbal-reasoning problems in which the experimenter personally mediated the primary rewards. After several weeks of such problem solving activities the insulin injections were discontinued and social rewards, which by this time had become more effective, were used in solving interpersonal problems that the patients were likely to encounter in their daily activities both inside and outside the hospital setting.

Comparison of the treated group with control groups, designed to isolate the effects of insulin and special attention, revealed that the patients in the reward group improved significantly in their social relationships in the hospital, whereas the patients in the control groups showed no such change.

King and Armitage (1958) report a somewhat similar study in which severely withdrawn schizophrenic patients were treated with operant conditioning methods; candy and cigarettes served as the primary rewards for eliciting and maintaining increasingly complex forms of behavior, i.e., psychomotor, verbal, and interpersonal responses. Unlike the Peters and Jenkins study, no attempt was made to manipulate the level of primary motivation.

An interesting feature of the experimental design was the inclusion of a group of patients who were treated with conventional interview therapy, as well as a recreational therapy and a no-therapy control group. It was found that the operant group, in relation to similar patients in the three control groups, made significantly more clinical improvement.

Skinner (1956b) and Lindsley (1956) working with adult psychotics, and Ferster (1959) working with autistic children, have been successful in developing substantial amounts of reality-oriented behavior in their patients through the use of reward. So far their work has been concerned primarily with the effect of schedules of reinforcement on the rate of evocation of simple impersonal reactions. There is every indication, however, that by varying the contingency of the reward (e.g., the patient must respond in certain specified ways to the behavior of another individual in order to produce the reward) adaptive interpersonal behaviors can be developed as well (Azran & Lindsley, 1956).

The effectiveness of social reinforcers in modifying behavior has been demonstrated repeatedly in verbal conditioning experiments (Krasner, 1958; Salzinger, 1959). Encouraged by these findings, several therapists have begun to experiment with operant conditioning as a method of treatment in its own right (Tilton, 1956; Ullman, Krasner, & Collins, in press; R. I.

Williams, 1959); the operant conditioning studies cited earlier are also illustrative of this trend.

So far the study of generalization and permanence of behavior changes brought about through operant conditioning methods has received relatively little attention and the scanty data available are equivocal (Rogers, 1960; Sarason, 1957; Weide, 1959). The lack of consistency in results is hardly surprising considering that the experimental manipulations in many of the conditioning studies are barely sufficient to demonstrate conditioning effects, let alone generalization of changes to new situations. On the other hand, investigators who have conducted more intensive reinforcement sessions, in an effort to test the efficacy of operant conditioning methods as a therapeutic technique, have found significant changes in patients' interpersonal behavior in extra-experimental situations (King & Armitage, 1958; Peters & Jenkins, 1954; Ullman et al., in press). These findings are particularly noteworthy since the response classes involved are similar to those psychotherapists are primarily concerned in modifying through interview forms of treatment. If the favorable results yielded by these studies are replicated in future investigations, it is likely that the next few years will witness an increasing reliance on conditioning forms of psychotherapy, particularly in the treatment of psychotic patients.

At this point it might also be noted that, consistent with the results from verbal conditioning experiments, content analyses of psychotherapeutic interviews (Bandura, Lipsher, & Miller, 1960; Murray, 1956) suggest that many of the changes observed in psychotherapy, at least insofar as the patients' verbal behavior is concerned, can be accounted for in terms of the therapists' direct, although usually unwitting, reward and punishment of the patients' expressions.

Punishment

While positive habits can be readily developed through reward, the elimination of socially disapproved habits, which becomes very much an issue in the treatment of antisocial personalities, poses a far more complex problem.

The elimination of socially disapproved behaviors can be accomplished in several ways. They may be consistently unrewarded and thus extinguished. However, antisocial behavior, particularly of an extreme form, cannot simply be ignored in the hope that it will gradually extinguish. Furthermore, since the successful execution of antisocial acts may bring substantial material rewards as well as the approval and admiration of associates, it is extremely unlikely that such behavior would ever extinguish.

Although punishment may lead to the rapid disappearance of socially disapproved behavior, its effects are far more complex (Estes, 1944; Solomon, Kamin, & Wynne, 1953). If a person is punished for some socially disapproved habit, the impulse to perform the act becomes, through its association with punishment, a stimulus for anxiety. This anxiety then motivates competing responses which, if sufficiently strong, prevent the occurrence of, or inhibit, the disapproved behavior. Inhibited responses may not, however, thereby lose their strength, and may reappear in situations where the threat of punishment is weaker. Punishment may, in fact, prevent the extinction of a habit; if a habit is completely inhibited, it cannot occur and therefore cannot go unrewarded.

Several other factors point to the futility of punishment as a means of correcting many antisocial patterns. The threat of punishment is very likely to elicit conformity; indeed, the patient may obligingly do whatever he is told to do in order to avoid immediate difficulties. This does not mean, however, that he has acquired a set of sanctions that will be of service to him once he is outside the treatment situation. In fact, rather than leading to the development of internal controls, such methods are likely only to increase the patient's reliance on external restraints. Moreover, under these conditions, the majority of patients will develop the attitude that they will do only what they are told to do—and then often only half-heartedly—and that they will do as they please once they are free from the therapist's supervision (Bandura & Walters, 1959).

In addition, punishment may serve only to intensify hostility and other negative motivations and thus may further instigate the antisocial person to display the very behaviors that the punishment was intended to bring under control.

Mild aversive stimuli have been utilized, of course, in the treatment of voluntary patients who express a desire to rid themselves of specific debilitating conditions. Liversedge and Sylvester (1955), for example, successfully treated seven cases of writer's cramp by means of a retraining procedure involving electric shock. In order to remove tremors, one component of the motor disorder, the patients were required to insert a stylus into a series of progressively smaller holes; each time the stylus made contact with the side of the hole the patients received a mild shock. The removal of the spasm component of the disorder was obtained in two ways. First, the patients traced various line patterns (similar to the movements required in writing) on a metal plate with a stylus, and any deviation from the path produced a shock. Following training on the apparatus, the subjects then wrote with an electrified pen which delivered a shock whenever excessive thumb pressure was applied.

Liversedge and Sylvester report that following the retraining the patients were able to resume work; a follow-up several months later indicated that the improvement was being maintained.

The aversive forms of therapy, described earlier in the section on counterconditioning procedures, also make use of mild punishment.

Social Imitation

Although a certain amount of learning takes place through direct training and reward, a good deal of a person's behavior repertoire may be acquired through imitation of what he observes in others. If this is the case, social imitation may serve as an effective vehicle for the transmission of prosocial behavior patterns in the treatment of antisocial patients.

Merely providing a model for imitation is not, however, sufficient. Even though the therapist exhibits the kinds of behaviors that he wants the patient to learn, this is likely to have little influence on him if he rejects the therapist as a model. Affectional nurturance is believed to be an important precondition for imitative learning to occur, in that affectional rewards increase the secondary reinforcing properties of the model, and thus predispose the imitator to pattern his behavior after the rewarding person (Mowrer, 1950; Sears, 1957; Whiting, 1954). Some positive evidence for the influence of social rewards on imitation is provided by Bandura and Huston (in press) in a recent study of identification as a process of incidental imitation. . . .

A more crucial test of the transmission of behavior patterns through the process of social imitation involves the delayed generalization of imitative responses to new situations in which the model is absent. A study of this type just completed, provides strong evidence that observation of the cues produced by the behavior of others is an effective means of eliciting responses for which the original probability is very low (Bandura, Ross, & Ross, in press).

Empirical studies of the correlates of strong and weak identification with parents, lend additional support to the theory that rewards promote imitative learning. Boys whose fathers are highly rewarding and affectionate have been found to adopt the father-role in doll-play activities (Sears, 1953), to show father-son similarity in response to items on a personality questionnaire (Payne & Mussen, 1956), and to display masculine behaviors (Mussen & Distler, 1956, 1960) to a greater extent than boys whose fathers are relatively cold and nonrewarding.

The treatment of older unsocialized delinquents is a difficult task, since they are relatively self-sufficient and do not readily seek involvement with a therapist. In many cases, socialization can be accomplished only through residential care and treatment. In the treatment home, the therapist can personally administer many of the primary rewards and mediate between the boys' needs and gratifications. Through the repeated association with rewarding experiences for the boy, many of the therapist's attitudes and actions will acquire secondary reward value, and thus the patient will be motivated to reproduce these attitudes and actions in himself. Once these attitudes and values have been thus accepted, the boy's inhibition of antisocial tendencies will function independently of the therapist.

While treatment through social imitation has been suggested as a method for modifying antisocial patterns, it can be an effective procedure for the treatment of other forms of disorders as well. Jones (1924a), for example, found that the social example of children reacting normally to stimuli feared by another child was effective, in some instances, in eliminating such phobic reactions. In fact, next to counterconditioning, the method of social imitation proved to be most effective in eliminating inappropriate fears.

There is some suggestive evidence that by providing high prestige models and thus increasing the reinforcement value of the imitatee's behavior, the effectiveness of this method in promoting favorable adjustive patterns of behavior may be further increased (Jones, 1924a; Mausner, 1953, 1954; Miller & Dollard, 1941).

During the course of conventional psychotherapy, the patient is exposed to many incidental cues involving the therapist's values, attitudes, and patterns of behavior. They are incidental only because they are usually considered secondary or irrelevant to the task of resolving the patient's problems. Nevertheless, some of the changes observed in the patient's behavior may result, not so much from the intentional interaction between the patient and the therapist, but rather from active learning by the patient of the therapist's attitudes and values which the therapist never directly attempted to transmit. This is partially corroborated by Rosenthal (1955) who found that, in spite of the usual precautions taken by therapists to avoid imposing their values on their clients, the patients who were judged as showing the greatest improvement changed their moral values (in the areas of sex, aggression, and authority) in the direction of the values of their therapists, whereas patients who were unimproved became less like the therapist in values. . . .

REFERENCES

Adams, J. K. Laboratory studies of behavior without awareness. *Psychol. Bull.*, 1957, **54**, 393–405.

Alexander, F. *Psychoanalysis and psychotherapy*. New York: Norton, 1956.

Alexander, F., & French, M. T. *Psychoanalytic therapy*. New York: Ronald, 1946.

Atkinson, Rita L. Paired-associate learning by schizophrenic and normal subjects under conditions of verbal reward and verbal punishment. Unpublished doctoral dissertation, Indiana University, 1957.

Azran, N. H., & Lindsley, O. R. The reinforcement of cooperation between children. *J. abnorm. soc. Psychol.*, 1956, **52**, 100–102.

Bandura, A., & Huston, Aletha C. Identification as a process of incidental learning. *J. abnorm. soc. Psychol.*, in press.

Bandura, A., Lipsher, D. H., & Miller, Paula E. Psychotherapists' approach-avoidance reactions to patients' expressions of hostility. *J. consult. Psychol.*, 1960, **24**, 1–8.

Bandura, A., Ross, Dorothea, & Ross, Sheila A. Transmission of aggression through imitation of aggressive models. *J. abnorm. soc. Psychol.*, in press.

Bandura, A., & Walters, R. H. *Adolescent aggression*. New York: Ronald, 1959.

Cairns, R. B. The influence of dependency-anxiety on the effectiveness of social reinforcers. Unpublished doctoral dissertation, Stanford University, 1959.

Calvin, A. D., Clifford, L. T., Clifford, B., Bolden, L., & Harvey, J. Experimental validation of conditioned inhibition. *Psychol. Rep.*, 1956, **2**, 51–56.

Davidson, J. R., & Douglass, E. Nocturnal enuresis: A special approach to treatment. *British med. J.*, 1950, **1**, 1345–1347.

Dittes, J. E. Extinction during psychotherapy of GSR accompanying "embarrassing" statements. *J. abnorm. soc. Psychol.*, 1957, **54**, 187–191. (a)

Dittes, J. E. Galvanic skin responses as a measure of patient's reaction to therapist's permissiveness. *J. abnorm. soc. Psychol.*, 1957, **55**, 295–303. (b)

Dollard, J., Auld, F., & White, A. M. *Steps in psychotherapy*. New York: Macmillan, 1954.

Dollard, J., & Miller, N. E. *Personality and psychotherapy*. New York: McGraw-Hill, 1950.

Dunlap, K. *Habits, their making and unmaking*. New York: Liveright, 1932.

Edmonson, B. W., & Amsel, A. The effects of massing and distribution of extinction trials on the persistence of a fear-motivated instrumental response. *J. comp. physiol. Psychol.*, 1954, **47**, 117–123.

Erikson, C. W. Unconscious processes. In M. R. Jones (Ed.), *Nebraska symposium on motivation*. Lincoln: Univer. Nebraska Press, 1958.

Estes, W. K. An experimental study of punishment. *Psychol. Monogr.*, 1944, **57** (3, Whole No. 363).

Eysenck, H. J. *The dynamics of anxiety and hysteria*. New York: Praeger, 1957.

Fenichel, O. *Problems of psychoanalytic technique*. (Trans. by D. Brunswick) New York: Psychoanalytic Quarterly, 1941.

Ferster, C. B. Development of normal behavioral processes in autistic children. *Res. relat. Child.*, 1959, No. 9, 30. (Abstract)

Fishman, H. C. A study of the efficiency of negative practice as a corrective for stammering. *J. speech Dis.*, 1937, **2**, 67–72.

Frank, J. D. The dynamics of the psychotherapeutic relationship. *Psychiatry*, 1959, **22**, 17–39.

Fromm-Reichmann, Frieda. *Principle of intensive psychotherapy*. Chicago: Univer. Chicago Press, 1950.

Heine, R. W. An investigation of the relationship between change in personality from psychotherapy as reported by patients and the factors seen by patients as producing change. Unpublished doctoral dissertation, University of Chicago, 1950.

Jones, E. L. Exploration of experimental extinction and spontaneous recovery in stuttering. In W. Johnson (Ed.), *Stuttering in children and adults*. Minneapolis: Univer. Minnesota Press, 1955.

Jones, H. G. The application of conditioning and learning techniques to the treatment of a psychiatric patient. *J. abnorm. soc. Psychol.*, 1956, **52,** 414–419.

Jones, Mary C. The elimination of childrens' fears. *J. exp. Psychol.*, 1924, **7,** 382–390. (a)

Jones, Mary C. A laboratory study of fear: The case of Peter. *J. genet. Psychol.*, 1924, **31,** 308–315. (b)

King, G. F., & Armitage, S. G. An operant-interpersonal therapeutic approach to schizophrenics of extreme pathology. *Amer. Psychologist*, 1958, **13,** 358. (Abstract)

Klein, Melanie. *The psycho-analysis of children*. London: Hogarth, 1949.

Krasner, L. The use of generalized reinforcers in psychotherapy research. *Psychol. Rep.*, 1955, **1,** 19–25.

Krasner, L. Studies of the conditioning of verbal behavior. *Psychol. Bull.*, 1958, **55,** 148–170.

Lacey, J. I., & Smith, R. I. Conditioning and generalization of unconscious anxiety. *Science*, 1954, **120,** 1–8.

Lazarus, A. A., & Rachman, S. The use of systematic desensitization in psychotherapy. *S. Afr. med. J.*, 1957, **32,** 934–937.

Lehner, G. F. J. Negative practice as a psychotherapeutic technique. *J. gen. Psychol.*, 1954, **51,** 69–82.

Lindsley, O. R. Operant conditioning methods applied to research in chronic schizophrenia. *Psychiat. res. Rep.*, 1956, **5,** 118–138.

Liversedge, L. A., & Sylvester, J. D. Conditioning techniques in the treatment of writer's cramp. *Lancet*, 1955, **1,** 1147–1149.

Martin, B., & Kubly, Delores. Results of treatment of enuresis by a conditioned response method. *J. consult. Psychol.*, 1955, **19,** 71–73.

Mausner, B. Studies in social interaction: III. The effect of variation in one partner's prestige on the interaction of observer pairs. *J. appl. Psychol.*, 1953, **37,** 391–393.

Mausner, B. The effect of one partner's success in a relevant task on the interaction of observer pairs. *J. abnorm. soc. Psychol.*, 1954, **49,** 557–560.

Max, L. W. Breaking up a homosexual fixation by the conditioned reaction technique: A case study. *Psychol. Bull.*, 1935, **32,** 734.

Meissner, J. H. The relationship between voluntary nonfluency and stuttering. *J. speech Dis.*, 1946, **11,** 13–33.

Meyer, V. The treatment of two phobic patients on the basis of learning principles: Case report. *J. abnorm. soc. Psychol.*, 1957, **55,** 261–266.

Miller, N. E., & Dollard, J. *Social learning and imitation*. New Haven: Yale Univer. Press, 1941.

Morgan, J. J. B., & Witmer, F. J. The treatment of enuresis by the conditioned reaction technique. *J. genet. Psychol.*, 1939, **55,** 59–65.

Mowrer, O. H. *Learning theory and personality dynamics*. New York: Ronald, 1950.

Mowrer, O. H., & Mowrer, W. M. Enuresis—a method for its study and treatment. *Amer. J. Orthopsychiat.*, 1938, **8,** 436–459.

Murray, E. J. The content-analysis method of studying psychotherapy. *Psychol. Monogr.*, 1956, **70** (13, Whole No. 420).

Mussen, P., & Distler, L. M. Masculinity, identification, and father-son relationships. *J. abnorm. soc. Psychol.*, 1959, **59,** 350–356.

Mussen, P., & Distler, L. M. Child-rearing antecedents of masculine identification in kindergarten boys. *Child Develpm.*, 1960, **31,** 89–100.

Payne, D. E., & Mussen, P. H. Parent-child relationships and father identification among adolescent boys. *J. abnorm. soc. Psychol.*, 1956, **52,** 358–362.

Peters, H. N. Multiple choice learning in the chronic schizophrenic. *J. clin. Psychol.*, 1953, **9,** 328–333.

Peters, H. N., & Jenkins, R. L. Improvement of chronic schizophrenic patients with guided problem-solving motivated by hunger. *Psychiat. Quart. Suppl.*, 1954, **28,** 84–101.

Rachman, S. The treatment of anxiety and phobic reactions by systematic desensitization psychotherapy. *J. abnorm. soc. Psychol.*, 1959, **58,** 259–263.

Raymond, M. S. Case of fetishism treated by aversion therapy. *Brit. med. J.*, 1956, **2,** 854–857.

Razran, G. Stimulus generalization of conditioned responses. *Psychol. Bull.*, 1949, **46,** 337–365.

Robinson, Nancy M. Paired-associate learning by schizophrenic subjects under conditions of personal and impersonal reward and punishment. Unpublished doctoral dissertation, Stanford University, 1957.

Rogers, C. R. *Client-centered therapy.* Boston: Houghton Mifflin, 1951.

Rogers, C. R. Group discussion: Problems of controls. In E. H. Rubinstein & M. B. Parloff (Eds.), *Research in psychotherapy.* Washington, D.C.: American Psychological Association, 1959.

Rogers, J. M. Operant conditioning in a quasi-therapy setting. *J. abnorm. soc. Psychol.*, 1960, **60,** 247–252.

Rosenthal, D. Changes in some moral values following psychotherapy. *J. consult. Psychol.*, 1955, **19,** 431–436.

Rotter, J. B. *Social learning and clinical psychology.* Englewood Cliffs, N.J.: Prentice-Hall, 1954.

Rubenstein, E. A., & Lorr, M. A comparison of terminators and remainers in outpatient psychotherapy. *J. clin. Psychol.*, 1956, **12,** 345–349.

Rutherford, B. R. The use of negative practice in speech therapy with children handicapped by cerebral palsy, athetoid type. *J. speech Dis.*, 1940, **5,** 259–264.

Salzinger, K. Experimental manipulation of verbal behavior: A review. *J. gen. Psychol.*, 1959, **61,** 65–94.

Sarason, Barbara R. The effects of verbally conditioned response classes on post-conditioning tasks. *Dissertation Abstr.*, 1957, **12,** 679.

Schmideberg, Melitta. Psychotherapy of juvenile delinquents. *Int. ment. hlth. res. Newsltr.*, 1959, **1,** 1–2.

Sears, Pauline S. Child-rearing factors related to playing of sex-typed roles. *Amer. Psychologist*, 1953, **8,** 431. (Abstract)

Sears, R. R. Identification as a form of behavioral development. In D. B. Harris (Ed.), *The concept of development: An issue in the study of human behavior.* Minneapolis: Univer. Minnesota Press, 1957.

Sheehan, J. G. The modification of stuttering through non-reinforcement. *J. abnorm. soc. Psychol.*, 1951, **46,** 51–63.

Sheehan, J. G., & Voas, R. B. Stuttering as conflict: I. Comparison of therapy techniques involving approach and avoidance. *J. speech Dis.*, 1957, **22,** 714–723.

Shoben, E. J. Psychotherapy as a problem in learning theory. *Psychol. Bull.*, 1949, **46,** 366–392.

Skinner, B. F. *Science and human behavior.* New York: Macmillan, 1953.

Skinner, B. F. Some issues concerning the control of human behavior. *Science*, 1956, **124,** 1057–1066. (a)

Skinner, B. F. What is psychotic behavior? In, *Theory and treatment of psychosis: Some newer aspects.* St. Louis: Washington Univer. Stud., 1956. (b)

Solomon, R. L., Kamin, L. J., & Wynne, L. C. Traumatic avoidance learning: The outcomes of several extinction procedures with dogs. *J. abnorm. soc. Psychol.*, 1953, **48,** 291–302.

Sullivan, H. S. *The interpersonal theory of psychiatry.* New York: Norton, 1953.

Thirmann, J. Conditioned-reflex treatment of alcoholism. *New Engl. J. Med.*, 1949, **241,** 368–370, 406–410.

Thompson, G. N., & Bielinski, B. Improvement in psychosis following conditioned reflex treatment in alcoholism. *J. nerv. ment. Dis.*, 1953, **117,** 537–543.

Tilton, J. R. The use of instrumental motor and verbal learning techniques in the treatment of chronic schizophrenics. Unpublished doctoral dissertation, Michigan State University, 1956.

Ullman, L. P., Krasner, L., & Collins, Beverly J. Modification of behavior in group therapy associated with verbal conditioning. *J. abnorm. soc. Psychol.*, in press.

Voegtlen, W. L. The treatment of alcoholism by establishing a conditioned reflex. *Amer. J. med. Sci.*, 1940, **119,** 802–810.

Wallace, J. A. The treatment of alcoholics by the conditioned reflex method. *J. Tenn. Med. Assn.*, 1949, **42,** 125–128.

Weide, T. N. Conditioning and generalization of the use of affect-relevant words. Unpublished doctoral dissertation, Stanford University, 1959.

Whiting, J. W. M. The research program of the Laboratory of Human Development: The development of self-control. Cambridge: Harvard University, 1954. (Mimeo)

Williams, C. D. The elimination of tantrum behaviors by extinction procedures. *J. abnorm. soc. Psychol.*, 1959, **59,** 269.

Williams, R. I. Verbal conditioning in psychotherapy. *Amer. Psychologist*, 1959, **14,** 388. (Abstract)

Wolpe, J. Recriprocal inhibition as the main basis of psychotherapeutic effects. *AMA Arch. Neurol. Psychiat.*, 1954, **72,** 205–226.

Wolpe, J. *Psychotherapy by reciprocal inhibition*. Stanford: Stanford Univer. Press, 1958.

Wolpe, J. Psychotherapy based on the principle of reciprocal inhibition. In A. Burton (Ed.), *Case studies in counseling and psychotherapy*. Englewood Cliffs, N.J.: Prentice-Hall, 1959.

Yates, A. J. The application of learning theory to the treatment of tics. *J. abnorm. soc. Psychol.*, 1958, **56,** 175–182.

49.

The Control of Eating*

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Although many investigators have described patterns of eating behavior and reported a wide range of factors related to obesity (1, 2, 5, 9, 10, 11), specific techniques for changing an individual's eating behavior are given little or no attention in published reports, and programs of weight control based on behavioral principles are virtually non-existent. This report is an account of the application of some elementary general principles of reinforcement theory (7) to the analysis of the behavior of the human eater. This theoretical framework of reinforcement was used to analyze actual performances in eating, and particularly self-control of eating. Supplementing the account of this system are descriptions of experimentally developed techniques which should illustrate practical applications of the theoretical principles of self-control.[1]

The theoretical analysis begins with the simple observation that the act of putting food in one's mouth is reinforced and strongly maintained by its immediate consequences: the local effects in the gastrointestinal system. But excessive eating results in increased body-fat and this is aversive to the individual. The problem is therefore to gain control of the factors which determine how often and how much one eats. An individual will manipulate these variables if the control of eating is reinforcing to him—if he escapes from or avoids the *ultimate aversive consequences of eating* (UAC). Unfortunately for the overeater, the long-term or ultimate aversive consequences of obesity are so postponed as to be ineffective compared with the immediate reinforcement of food in the mouth. Alcoholism is a similar example in which hangover symptoms and the full impact of asocial activity are not suffered until considerable time has elapsed. Realization of self-control, then, demands an arrangement that will bring the influencing conditions into closer association with the reduction of eating behavior.

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[1] The experiments are still underway and will be reported separately by the second and third authors.

The analysis and development of self-control in eating involves four steps:

1. *Determining what variables influence eating.* Almost every known behavioral process is relevant to this. Among these are control of eating by stimuli, effect of food deprivation, chaining, avoidance and escape, prepotent and competing behaviors, conditioned alimentary reflexes, and positive reinforcement (2).

2. *Determining how these variables can be manipulated.* Specification of performances within the repertoire by which the individual can manipulate these variables. One example would be the choice of foods which are weak reinforcers, yet rewarding enough to maintain the behavior of eating them at some low level.

3. *Identifying the unwanted effects (UAC) of overeating.* Avoidance of these is the basic motive for developing the required self-control.

4. *Arranging a method of developing required self-control.* Some of the required performances may call for so drastic a change of behavior that it may be necessary to produce the required repertory in stages by reinforcing successive approximations.

Self-control requires for our purposes a more precise definition than is conveyed by the term "will-power." It refers to some specific performances which will lower the disposition to emit the behavior to be controlled. These performances involve the manipulation of conditions influencing this behavior. A convenient datum for our analysis is the *frequency* of the behavior's occurrence. The strength, durability or persistence of the behavior is measured by its frequency. Frequency has the measurement advantage of being a continuous variable. Similarly, the disposition to eat can vary from small to large. The various conditions which the individual himself can manipulate to lessen the frequency of the controlled behavior will be presented in detail in the next section, *Avenues of Self-Control.* The technical problem of generating the self-control performance and maintaining it in strength will be dealt with in the section, *Shaping and Maintaining the Self-Control Performance.*

Avenues of Self-control

THE ULTIMATE AVERSIVE CONSEQUENCES

Avoidance of the ultimate aversive consequences (UAC) of uncontrolled eating is essential in developing performances with which a person may regulate his eating behavior. Self-control is needed because of the time lapse between the act of eating and its UAC. To overcome this time lapse, techniques were sought which would derive a conditioned stimulus from the UAC and apply it at the time the disposition to eat was strong. This is based on the principle that almost any event may become aversive when paired with a known aversive event. Such a conditioned stimulus may be the person's own verbal behavior, if specific training procedures are applied. It is not enough for the subject to *know* what the aversive effect of overeating is, for such knowledge by itself leads only to verbal responses weaker than the food-maintained behavior and may not lessen the strong disposition to eat. Therefore an extensive repertoire must be established so that the subject has under his control large amounts of verbal behavior dealing with the consequences of eating. The continued intensive pairing of facts about the UAC with various kinds of eating performance will make the performances themselves conditioned aversive stimuli. Once a given performance such as eating a piece of pie acquires conditioned aversive properties, any approach to it will produce aversive stimuli. These stimuli will reinforce any self-control because the self-control terminates the aversive stimulus and prevents the un-controlled act. By such a process, certain foods like pies, cakes, cokes, doughnuts or candy may become conditioned aversive stimuli, at least until other avenues of control become available.

Before the unwelcome consequences of overeating can be used in developing self-control, they must be identified and developed for the individual. It cannot be assumed that an obese person already has a repertoire about the UAC of eating. In the application of the principles to human subjects being studied, the development of the UAC was one of the major parts of the practical program. However, developing a repertoire by which the subjects could create an aversive state of affairs for themselves presents serious technical problems. First, to establish this repertoire, the actual aversive events must be identified for the subject in terms that are meaningful for his daily life. Second, the subject must learn an active verbal repertoire with which he can translate caloric intake into ultimate body fat.

We first disclosed, in great detail, the consequences of uncontrolled eating for each individual. After each subject described anecdotes about UAC in group sessions, we helped each one to develop a fluent verbal repertoire about the relevant aversive consequences. We found that simply *recognizing* the various aversive consequences did not give these subjects an active verbal repertoire which could be invoked immediately and whenever needed. To develop an active repertoire about the UAC, we arranged rehearsals, frequent repetitions, and written examinations. In general, the subjects were unaware of their inability to verbalize the relevant aversive consequences, and were surprised by the poor results of the early written and oral examinations. Verbal descriptions of aversive consequences the subjects had actually experienced were far more compelling than reports of future and statistically probable consequences, such as diabetes, heart disease, high blood pressure, or gall bladder disorder. In other words, descriptions of actual or imagined social rejection, sarcastic treatment, extreme personal sensitivity over excess weight, demeaning inferences concerning professional incompetence or carelessness, or critical references to bodily contours or proportions were much more potent. All of our subjects found their constant and unsuccessful preoccupation with dieting aversive, and any ability to control their own habits highly rewarding.

All of the exercises in this area were designed to develop a strong and vivid repertoire that could be introduced promptly in a wide variety of situations intimately associated with eating and despite a strong inclination to eat. The actual aversive effects of being overweight are largely individual matters which differ widely from person to person. We therefore used group discussions as an aid for each person to discover how her body weight affected her life. The discussion was guided toward explicit consequences and anecdotes rather than general statements such as "I want to lose weight because I will feel better." We found that after only four or more group sessions, subjects shifted from vague statements such as "I'll look better in clothes" to specific ones such as "My husband made a sarcastic remark about an obese woman who crossed the street as we were driving by." Perhaps, the verbalization of the UAC was too aversive before we had demonstrated that self-control was possible.

AMPLIFYING THE AVERSIVE CONSEQUENCES OF OVEREATING

To establish the bad effects of eating more than one's daily requirements, it is necessary that the individual know the metabolic relationships between different kinds of food, general level of activity, and gain or loss of weight. Phrases like "Everything I eat turns to fat" illustrate that the required repertoire is frequently absent. Thorough training should be given in the caloric properties of all of the kinds of foods which the individual will encounter. The aversive effects of eating certain undesirable foodstuffs can be amplified by generating verbal repertories which describe the full consequences of eating them. For example, the subject should be made to recognize that a 400-calorie piece of pie is the caloric equivalent of a large baked potato with butter plus a medium-size steak. The pie is equivalent to one-tenth of a pound of weight gained, and so forth. Again, *knowing* these facts is not at issue. The issue is that a strong-enough repertoire be established, and with enough intraverbal connections, that the UAC behavior will occur with a high probability in a wide enough variety of situations.

An important exercise early in the weight-control program is the identification of the individual's actual food intake. The subject's casual summaries of his daily food intake are likely to be grossly inaccurate. His ability to recognize his actual food intake is improved by an interview technique in which the interviewer probes and prompts him: "What did you have for breakfast?" "How many pieces of toast?" "How many pieces of bread?" "What did you do between ten and eleven in the morning?" "Were you at a snack bar or a restaurant at any point during the day?" "Were you offered any candy at any point?" and so forth.

With the pilot subjects, we leaned most heavily on a written protocol which we used as a basis for individual interviews about their diets. Each subject kept a complete written account of everything she had eaten, along with calculations of fat, carbohydrate, protein, and numbers of calories. A large part of the early sessions was devoted to problems in recording food intake, such as difficulties in estimating mixed foods like gravies, stews, or sauces.

For the first four weeks of the program, when some simpler kinds of self-control were developed, the subjects' caloric intake was set to maintain a constant weight. We over-estimated the maintenance levels, and all subjects gained weight during this month. However, the weight increase proved the relationship between caloric intake and weight change in a situation where the caloric intake was carefully defined. In spite of the weight gain, however, some measure of self-control emerged, particularly in changes in the temporal pattern and regularity of eating.

Deprivation

The effect of food deprivation may be observed in a pigeon experiment in which the frequency of a pigeon's key pecking, maintained by producing food, is measured as a function of changes in the level of food deprivation. Changes in the level of food deprivation produce continuous changes in the bird's performance over an extremely wide range if we can measure the frequency of the bird's pecking. This frequency of pecking is intuitively close to notions like the bird's disposition to eat, probability of action, or motivation. When a wide range of frequency response can be measured sensitively, the level of deprivation affects the bird's performance continuously, from free-feeding body weight to as low as 65 or 70 per cent of normal body weight. Food deprivation of the order of six to twenty-four hours constitutes a very small part of the effective range. The magnitude of food deprivation therefore continues to increase the organism's disposition to emit responses, reinforced by food, long after no further changes occur in gastrointestinal reactions (e.g., hunger pangs) and other conditioned effects of food in the mouth. The hunger pangs, which are ordinarily taken as symptoms of hunger (from which the effect of food deprivation is inferred), are more closely related to the conditioned stimuli accompanying past reinforcements of eating than to the level of food deprivation. The conditioned reflexes involving the gastrointestinal system occur at relatively low levels of deprivation compared with the effective range of food deprivation in respect to the changes in frequency of operant behavior. There may be a similar lack of correspondence between the tendency to verbalize, introspectively, reports of hunger and the actual disposition to eat. For purposes of developing self-control, the actual performances resulting in food in the mouth are more relevant than the introspective reports of "hunger."

Controlling the rate at which the subject loses weight proves to be a major technique of self-control. For any degree of establishment of a self-control repertoire, there is probably some level of food deprivation which will cause the subject to eat in spite of the self-control behavior. Therefore, a major principle of self-control would be to pace the rate of the subject's weight loss so that the effect of the weight loss on the disposition to eat would be less than the given stage of development of self-control. Many avenues of self-control may be learned without causing any weight loss. Placing the eating behavior under the control of specific stimuli or breaking up the chain of responses usually present in the compulsive eater are examples of this. The former will be discussed below. Breaking up a chain causes the eating performances to become a series of discrete acts which are more easily interrupted than a continuous performance in which each chewing response or each swallow occasions placing the next bit of food on the fork.

If the self-control performances which

may be developed are to be useful, they must be maintained by conditions which will be present continuously, even after the weight-control therapy procedures are discontinued. Many unsuccessful crash diet programs illustrate the way in which too rapid a loss of weight produces a level of deprivation and a disposition to eat exceeding the existing self-control. The usual diet involves some program which taps the motivation of the dieter temporarily. For example, slight aversive pressure from the husband or family doctor may produce a rapid loss in weight, perhaps on the order of three to five pounds a week. The effect of the rapid weight loss is a large increase in the disposition to eat which then overcomes the subject's temporary motive.

Limiting the diet to one specific food, such as protein, probably will produce a heightened disposition to eat other foodstuffs regardless of the general weight level. These are the traditional specific hungers. An all-protein diet, for example, even if taken without limit of calories, would probably generate an enormous disposition to eat carbohydrates, sugars, and fats. Therefore, a balanced diet should be maintained and a weight loss brought about by a uniform reduction in amount rather than kind of food.

Although the major effects of food deprivation appear when weight losses are of the order of pounds, the time elapsed since eating would have local effects on the disposition to eat. Local satiation effects may best be used as a limited avenue of self-control by arranging the eating schedules so that the subject ingests a meal or a significant amount of food just before a situation in which the disposition to eat might be unusually strong. An example is a social situation in which eating has frequently occurred in the past or when preferred foods are present. The housewife who eats continuously while preparing dinner can control the disposition to nibble the foods being prepared by shifting the preparation of the dinner meal to the period of time immediately following lunch, when her disposition to eat is lower because she has just eaten.

In the application of the self-control principles to actual exercises, we specified a weight loss of one pound per week and insisted that our subjects adhere to this rate of weight loss even though each of them wanted to cut her diet more stringently in order to lose weight at a greater rate. Different rates of weight loss might possibly be arranged at different stages of development of self-control after more is known about the effectiveness of different avenues of self-control and about the relative effects of weight loss depending upon the initial level.

The continued ingestion of food during a meal provided another variation in level of food deprivation which was used to provide a gradual transition to the final self-control performances. Exercises, such as brief interruptions in eating were first carried out toward the end of the meal when some satiation had occurred. After the subjects began to learn how to use auxiliary techniques to stop eating and their existing eating patterns began to break down, the exercises were moved progressively toward the early part of the meal, when their levels of deprivation were higher so that the exercises had to be more difficult.

SELF-CONTROL BY MANIPULATING STIMULI

The characteristic circumstances when an individual eats will subsequently control his disposition to eat. The process is illustrated by the pigeon whose key pecking produces food only when the key is green and not when it is red. The frequency with which the pigeon pecks the key (reinforced by food) will later depend upon which color is present. Thus, changing the color of the key can arbitrarily increase or decrease the frequency of pecking independently of the level of food deprivation. A frequent factor in the lack of self-control in the obese person may be the large variety of circumstances in which eating occurs. In contrast, a much narrower range of stimuli is present during the more infrequent eating periods of the controlled person. Therefore, the disposition to eat possibly could be decreased by narrowing the range of stimuli which are the occasions for the reinforcement by food. By proper choice of the actual stimuli controlling the eating behavior, it should also be possible to increase the individual's control over these stimuli. There are circumstances when even the pathologically compulsive eater will have a considerably lower disposition to eat for periods of time simply because the environment is novel enough so that eating has never occurred then. Consider, for example, walking in an isolated forest area.

The first step in the development of self-control in this category is to narrow the range of existing stimuli which control eating. The overweight individual eats under a large variety of circumstances. Thus, the problem of self-control is made difficult by the large number of daily occasions which bring the tendency to eat to maximal levels because in the past they have been the occasions when eating has occurred. Two kinds of behavior need to be brought under stimulus control. The first is the elicited reflex effects of food, such as salivation, gastric secretion, and other responses of the gastrointestinal tract. The other involves operant behavior, or the behavior involving the striated musculature of the organism—walking, talking, reaching, cooking, and so forth. In the so-called voluntary behaviors, the major datum is the frequency of the behavior rather than the magnitude of an elicited reflex, as with the smooth-muscle response of the digestive system. Although these two types of behavioral control are inevitably tied together, their properties are different and they must be distinguished both dynamically and statically. In order to break down the control of eating by the stimuli which have been the characteristic occasions on which eating has been reinforced in the past, the stimuli must occur without the subsequent reinforcement by the food. The process is a direct extrapolation from the extinction of a Pavlovian conditioned response. If the dog is to discontinue salivation on the occasion of the bell, the bell must be presented repeatedly in the situation in which the food no longer follows. The amount of saliva the bell elicits then declines continuously until it reaches near-zero. Similarly, the stimuli characteristic of the preparation of a meal will cease to control large amounts of gastric activity if these stimuli can be made to occur without being followed by food in the mouth. Initially, the stimuli will elicit large amounts of gastric activity; but with continued exposure to these stimuli, the amount of activity will decline continuously until low levels are reached.

Delimiting existing stimulus control of eating may take considerable time because (1) the loss of control by a stimulus is a gradual process, requiring repeated exposure to the relevant stimuli; and (2) it may be a long time before the individual encounters all of the situations in which he has eaten in the past. The sudden temptation of the ex-smoker to light a cigarette when he meets an old friend is an example of the latter kind of control.

Self-control developed under procedures involving very special situations and foods (for example, liquid diets, all-protein diets, or hard-boiled eggs and celery) will be difficult to maintain when the diet circumstances return to normal. The very abrupt shift in eating patterns, kinds of food eaten, and characteristic circumstances surrounding eating will weaken the self-control performances as well as strengthen eating behaviors which were previously in the person's repertoire under the control of the more normal environment. Hence, self-control performances must be developed under circumstances and with foods which are to be the individual's final eating pattern.

TEMPORAL CONTROL OF EATING

The time of day is an important event controlling eating. With the individual who characteristically eats at regular intervals, gastric activity comes to precede these occasions very closely, and is at low levels elsewhere regardless of levels of deprivation. The same can be said for operant behavior associated with eating, although the order of magnitude of some of the parameters may be different. After the conditioned responses associated with eating are brought closely under the control of a strict temporal pattern, feelings of hunger should disappear except just before meal-time. However, many individuals have no such routine patterns of eating, so that the temporal pattern of eating does not limit the amount of gastrointestinal activity. The obese person frequently eats in the absence of any gastric activity. A technique of self-control in this category would rigidily specify a temporal pattern of eating and find conditions for adhering to it. As with the gastrointestinal reflexes, this general disposition to engage in operant behaviors reinforced by the ingestion of food can be brought under the control of a temporal pattern of eating, with a resulting lower disposition to eat during the intervals between regular meals. In the early stages of learning self-control, the development of a rigid temporal pattern perhaps should be carried out under conditions in which no weight loss is to be expected and the amount of food, ingested at specified meals, is large enough to minimize the disposition to eat on other occasions. The subsequent maintenance of this temporal pattern of eating when the subject begins to lose weight will depend upon the concurrent action of other categories of self-control performances. The control of eating by temporal factors can also be developed for situations other than the normal routine meals as for example, at social gatherings and parties. Because the availability of food is predictable here, early stages of self-control can include arranging a specific time when the eating will occur rather than indeterminate consumption of whatever foods happen to be available.

THE EATING SITUATION

As with the temporal properties of eating, the actual characteristics of the eating situation may be used to control the disposition to eat. However, the stimuli here are clearer and probably exert control of an even larger order of magnitude than that of the temporal pattern. This application of the principle of stimulus control is the same as in the temporal contingency: to arrange that eating occur on limited and narrowly circumscribed occasions and never otherwise. To simplify the development of the stimulus control, eating situations should be associated with stimuli which occur infrequently in the individual's normal activities. For example, an eating place in the home should be chosen so that it is maximally removed from the routine activities of the day. Nor should eating occur together with any other kind of activity such as reading. If reading occurs frequently enough while the subject is eating, then reading will increase the disposition to eat because it has been an occasion on which eating has been reinforced.

EMPHASIZING THE STIMULUS CONTROL

The occasions characterizing eating can be emphasized by deliberately arranging very obvious stimuli. For example, the subject always eats sitting down at a table which has a napkin, a place setting, and a purple table cloth. The latter makes the situation even more distinctive. In the extreme case, a specific item of clothing might be worn whenever the subject eats. Narrowing the range provides another form of stimulus control. By eating only specific foods in specific places, the disposition to eat when other foods are available will be minimized. This factor will also be discussed under chaining; but the aspect emphasized here is the effect of the foods eaten as one of the elements in the occasion associated with eating. If a subject has eliminated ice cream, candy, and cake from his diet, the sweet shop will have little control over his behavior.

In the actual procedures with subjects, stimulus control was the first avenue of self-control developed. The subjects learned to keep daily diet protocols during the first few meetings and to determine the number of calories necessary to maintain their weight. We restricted eating to three meals a day, eliminated concentrated fats and sugars from the diet, and attempted to bring about an increase in the amount of food taken in at meals, particularly at breakfast, to bring about a normal pattern of eating without any expected weight loss. For individuals having difficulty in restricting their eating to meals, we arranged a specific and routine extra feeding, as, for example, a glass of milk and a few crackers at bedtime. The extra feeding was to be taken routinely, however, so it did not become a reinforcer for increasing the probability of eating on a wide variety of occasions. No weight loss was attempted until the subjects were successful in eating a normal range of food at meals without any eating at other times. We attempted to create an eating pattern which could be carried out without interruption after the weight-control program was terminated. Our major problems were insufficient protein or excess fat in the diet. None of the subjects ate excessive amounts of carbohydrate except perhaps as candy. However, all subjects had trouble eating a full meal. It was paradoxical that women who joined the program because they could not limit their eating had difficulty in ingesting a maintenance diet at mealtimes. One complained of nausea, another of chest pains, and a third of discomfort from overeating. All of the complaints disappeared in a week, however.

CHAINING

Eating is a rough designation for a chain of behavioral sequences culminating in swallowing and the subsequent gastrointestinal reflexes. An illustrative sequence might be as follows: Dressing makes possible leaving the house; leaving the house leads to walking to the store; entering the store is followed by the selection of foods; a basket of food is the occasion for paying the clerk and leaving the store; a bag of groceries at home leads to storing the food; stored food is the occasion for cooking or otherwise preparing the food; the prepared food is the occasion for setting the table and sitting down; the sight of food is the occasion for cutting it with a fork or knife; the dissected food leads to placing food in the mouth; food in the mouth is followed by chewing; and chewing is followed by swallowing. The sequence differs from individual to individual and from time to time, but any selected elements illustrate the process.

Because the frequency of occurrence of the final member of the chain depends on the nature of the earlier members of the eating sequence, some degree of self-control can be arranged by dealing with the dynamic properties of the eating sequence. The length of the chain of responses leading to swallowing will markedly influence the frequency with which the eating sequence is carried out. The longer the sequence of behaviors in the chain and the more behavior sequences in each member of the chain, the weaker will be the disposition to start the chain. This property of chaining suggests a technique of control which could be useful if used in conjunction with the other avenues of control. By arranging that all of the foods available or accessible require a certain amount of preparation or locomotion, the tendency to eat can be reduced simply because the chain of responses leading to swallowing was lengthened. Keeping food out of areas normally entered, shopping on a day-to-day basis (at a time when the disposition to eat is low), buying foods which are not edible without cooking or other preparation, and placing food in less accessible places are some techniques for weakening the disposition to eat by lengthening a chain. As in some of the avenues of control, this technique would be inadequate under extreme levels of deprivation without additional support from other types of control. The chain must not be lengthened too much, or it might become so weakened that prepotent eating behaviors would occur or the chain shortcircuited.

The actual form of the eating chain in the latter members just before swallowing may be rearranged to reduce the rate of eating. The behavior of swallowing is so strongly reinforced that it could occur very soon after food enters the mouth, without very much chewing. Similarly, the behavior of placing food in the mouth (reinforced by the taste of food) has high strength and occurs as soon as the mouth empties. Many eaters carry out this sequence at a very high rate by reaching for additional food just as soon as food is placed in the mouth and by swallowing while the fork is in transit to the mouth. This analysis is confirmed by the high rate with which many obese people eat compared with that of non-obese eaters.

To reduce the rate of eating and to make it possible for the subject to stop eating at any point, we designed simple exercises to break the chain, particularly the near-final members, so that the occasion for placing food on the fork is swallowing rather than chewing. The new sequence was: food on the fork only after other food is swallowed and the mouth is empty. These exercises depended on ancillary techniques of control already developed by other techniques of self-control. At the start, the interruptions were only a few seconds, then they were gradually increased to several minutes. The ability to stop eating at *any* point represents the final effect of nearly all of the other avenues of control; nevertheless, it constitutes a separate technique of control demanding special exercises. In later, more difficult exercises, the subject holds food on a fork for various periods of time without eating. Similarly, chewing is prolonged before swallowing for increasing periods. These exercises are carried out initially at the end of a meal, when the deprivation level is low.

The type of food eaten is of major importance in how reinforcing it would be, and hence how long a chain of responses can be maintained by the food reinforcement. The disposition to eat could be somewhat regulated by a selection of foods in the individual's diet that are sufficiently reinforcing (appetizing, caloric, etc.) to be eaten, but minimally reinforcing so as to minimize the resulting disposition to eat. A certain balance must be achieved; if the foods chosen are so unappetizing or unappealing that their reinforcing effect is negligible, the subject will simply switch to other foods. Also relevant here are the dynamic effects of food deprivation. Foods which are maximally reinforcing should be eaten when the individual is less deprived, and minimally reinforcing foods should be eaten under stronger conditions of deprivation. In other words, the effect of the highly reinforcing foodstuffs on the disposition to eat would be minimized by a lower level of deprivation so that the subject can stop eating more easily. In special cases, the food intake could be increased temporarily in order to minimize the highly reinforcing effect of certain foods. For example, if an individual who is highly reinforced by caloric pastries knows she will be in a situation where such pastries are being served, she could lessen the probability of eating them by increasing her food intake during the preceding meal or by a glass of milk before entering the situation.

PREPOTENT REPERTOIRES

One way to lessen the disposition to eat is to supplant it by establishing other activities incompatible with eating. In an extreme case, an apparently large disposition to eat is often due to a behavioral repertoire in which eating appears strong because the rest of the repertoire is weak. Some degree of self-control should be possible if some activity could be maintained at a potentially high strength and circumstances arranged so that the subject could engage in this activity whenever the disposition to eat was strong. An example of such an activity might be telephoning a friend just after breakfast instead of indulging in the customary between-meal nibbling. The use of prepotent repertoires as a technique of control implies a certain amount of control over the prepotent repertoire. In order for these substitutive repertoires to be effective, special attention must be given to methods for strengthening them, particularly when they are needed. For example, instead of reading the newspaper as soon as it arrives, it could be put aside until some time when the peak tendency to eat occurs. Similarly, the telephoning of friends could be postponed in order to keep this behavior at high strength. Such activities occur initially because of independent reinforcement. Another kind of prepotent repertoire may be established by starting some strongly reinforced activity whose reinforcement occurs only if the behavior occurs uninterrupted for a period of time. Examples are washing a floor, going to a movie, taking a bus ride, reading a short story, or going for a walk. Such performances will be prepotent over eating because of the temporary aversive consequences resulting from their interruption. In many cases, the prepotent repertoires physically remove the individual from the place where eating can occur.

The effective use of prepotent repertoires depends upon the development of other avenues of control. Probably no one of these "prepotent" performances would be effective by itself if the disposition to eat were strong. For example, the individual going for a walk could simply stop at a restaurant to eat. Nevertheless, there is still a net advantage, because the supplementary types of self-control needed are relatively easy. For example, compare the disposition to stop at a restaurant during a walk with the disposition to eat in the normal situations when eating usually occurs. If the individual usually eats at home, the tendency to stop at a restaurant and eat will be considerably less than the tendency to eat at home. No explicit training was required in the pilot experiment to establish self-control by the use of prepotent repertoires; but all of the subjects used them during several phases of the experiment.

Prepotent repertoires may be affected by emotional factors. For example, many persons eat when depressed, affronted, thwarted, or frustrated. In the terms of the functional analysis of eating used here, emotional factors may weaken behaviors other than eating so that eating becomes relatively stronger. Putting food in one's mouth remains a highly reinforcing activity even if the remainder of the individual's repertoire is severely depressed. Eating then occurs because it is less disrupted by the emotional variables depressing the rest of the individual's repertoire.

Eating may interact with emotional factors in more subtle, but nonetheless important, ways, as a mechanism by which a person might escape or avoid emitting verbal behavior which is highly aversive, e.g., thinking about impending circumstances which are highly aversive. Because of its very strong and immediate reinforcement, eating will be prepotent over thinking about anxiety-evoking occurrences. Thus, eating comes to acquire two sources of strength: The immediate reinforcement from food in the mouth, and the reinforcement from postponing or avoiding the aversive consequences of emitting the verbal behavior which the eating supplants. Emotional disturbances will also disrupt the performances by which the individual controls himself, as will any general depression or disturbance of the individual's over-all repertoire. Self-control performances will be especially liable to disruption early in their development, before they become strong and maintained.

The manipulation of factors to minimize the effects of emotional disturbances is a separate topic, involving self-control of variables different from those in eating and thus requiring a separate analysis. The main avenue of control in eating lies in increasing the strength and durability of the self-control performances so that they will remain intact during emotional disturbances. For example, a person who has acquired an active and extensive verbal repertoire about all of the personal aversive consequences of being overweight will be able to emit these behaviors even during some general depression of his behavioral repertoire. The behavior about the ultimate aversive consequences of eating will be even more durable during possibly disrupting situations if it has already been effective in producing self-control, that is, if the behavior about the UAC has been reinforced effectively by suppression of the disposition to eat.

If existing levels of self-control are certain to break down because of an emotional disturbance, the individual should be trained to plan a controlled increase in food intake. The advantage of explicitly increasing the level of food intake would be that the food would be eaten under controlled conditions, so that stimulus control and other factors of self-control already developed would be maintained, and the effects of absence of progress in self-control would be minimized. Overeating under planned conditions would probably weaken the already developed self-control repertoires less than unplanned or uncontrolled eating.

In many situations, the general depression of an individual's repertoire occurs only for a limited time. Here, the necessary self-control performances would be a manipulation of the physical environment so that food is not available then, or would be the creation of a prepotent environment. The depressed individual who wishes to control his eating goes to a movie, takes a ride on a bus, or goes for a long walk. These activities give time for the emotional states to disappear and simultaneously provide an environment in which eating has not been reinforced very frequently in the individual's past experience. Of course, applications of these techniques of control depend upon the prior achievement of a certain amount of self-control, and probably are some of the most difficult areas of self-control to acquire. Such items would not be attempted at an early stage of the self-control program. . . .

DISCUSSION

. . . Most of the present report is a presentation of certain practical techniques which can be applied to the problem of uncontrolled eating. The preliminary results of this pilot program are not included as a record of even mediocre success, but rather as a description of the medium within which the specific techniques of control were imparted. A much longer follow-up period and a larger number of cases are necessary to develop a successful program as well as test it. Nor can we now designate these aspects of the program which were effective or ineffective. This report is intended to provide a theoretical and practical model for more structured programs of self-control in eating. We have shown eating habits can be changed in a short-term, small-group-therapy program by the use of the basic principles outlined here. Whether or not the weight losses reported during the first 15 sessions are primarily due to the application of the principles outlined can be determined only by appropriately controlled study experiments. We are not concerned whether one or another program can effect weight loss, since many pharmacologic individual- and group-therapy programs lead to temporary loss of weight, as is generally known. The central issue is the development of self-control in eating which will endure and become an available part of the individual's future repertoire. Most conventional programs do not focus on the eating patterns available to the subject after he has lost weight, nor do they present recognizable techniques for developing such future control. Possible exceptions are in individual programs of psychotherapy which are directed toward an exploration and resolution of the unconscious determinants of eating behavior, and in certain of the conditioned-reflex techniques. Yet, even in these programs, this question remains: Do proper eating habits exist after the individual is free of the relevant disability? The program outlined here has the special advantage of focusing directly and specifically on future eating behavior and of presenting even more specific techniques for bringing this behavior under control. Application of the basic principles requires no special instrumental or technical training and is relatively economical. Slow and controlled weight loss under relatively high-caloric intake levels minimizes medical and psychological problems.

We cannot state whether the program we carried out is suitable for severely obese individuals (particularly those who have medical or psychiatric complications). Nor can we specify how the technical principles and procedures can be applied to subjects of low educational level or of limited intelligence. A major problem here would undoubtedly be the difficulty of daily and accurate caloric-intake records. Some of these fundamental questions are subjects for future study.

REFERENCES

1. Bruch, H. *The importance of overweight.* New York: W. W. Norton, 1957.
2. Cappon, D. Obesity. *Canadian Medical Association Journal,* 1958, **78,** 568–573.
3. Ferster, C. B. Reinforcement and punishment in the control of human behavior by social agencies. *Psychiatric Research Report,* 1958, **10,** 101–118.
4. Ferster, C. B., and Skinner, B. F. *Schedules of reinforcement.* New York: Appleton-Century-Crofts, 1957.
5. Galvin, E. P., and McGavack, T. H. *Obesity, its cause, classification and care.* New York: Hoeber-Harper, 1957.
6. Skinner, B. F. *The Behavior of organisms.* New York: D. Appleton Century Co., 1938.
7. Skinner, B. F. *Science and human behavior.* New York: Macmillan, 1958.
8. Skinner, B. F. *Cumulative record.* New York: Appleton-Century-Crofts, 1959.
9. Stunkard, A. The results of treatment for obesity. *Archives of Internal Medicine,* 1959, **103,** 79–85.
10. Stunkard, A. Eating patterns and obesity. *Psychiatric Quarterly,* 1959, **33,** 284–295.
11. Stunkard, A. Obesity and the denial of hunger. *Psychosomatic Medicine,* 1959, **21,** 281–289.

Bibliography

1. Bandura, A. Social learning through imitation. *Nebraska Symposium on Motivation*. (M. R. Jones, ed.). Lincoln: Nebraska Univer. Press, 1962.
2. Braithwaite, R. B. *Scientific Explanation*. Cambridge: Cambridge Univer. Press, 1955.
3. Dollard, J. and Miller, N. E. *Personality and Psychotherapy*. New York: McGraw-Hill, 1950.
4. Eysenck, H. J. (ed.) *Behaviour Therapy and the Neuroses*. New York: Pergamon Press, 1960.
5. Keller, F. S. and Schoenfeld, W. N. *Principles of Psychology*. New York: Appleton-Century-Crofts, 1950.
6. Miller, N. E. and Dollard, J. *Social Learning and Imitation*. Yale Univer. Press, 1941.
7. Mowrer, O. H. *Learning Theory and the Symbolic Processes*. New York: John Wiley & Sons, 1960.
8. Nuthman, A. M. Conditioning of a response class on a personality test. *J. abnorm. soc. Psychol.*, 1957, **54**, 19–23.
9. Oakes, W. F. and Droge, A. E. Operant conditioning of responses to social introversion scale items on the MMPI. *Psychol. Reps.*, 1960, 6, 223–225.
10. Osgood, C. E. *Method and Theory in Experimental Psychology*. New York: Oxford Univer. Press, 1953.
11. Skinner, B. F. *Verbal Behavior*. New York: Appleton-Century-Crofts, 1957.
12. Staats, A. W. and Staats, C. K. *Complex Human Behavior*. New York: Holt, Rinehart and Winston, 1963.
13. Wolpe, J. *Psychotherapy by Reciprocal Inhibition*. Palo Alto: Stanford Univer. Press, 1958.

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